VOLUME XXIV NUMBER FIVE

THE NATIONAL GEOGRAPHIC MAGAZINE

MAY, 1913

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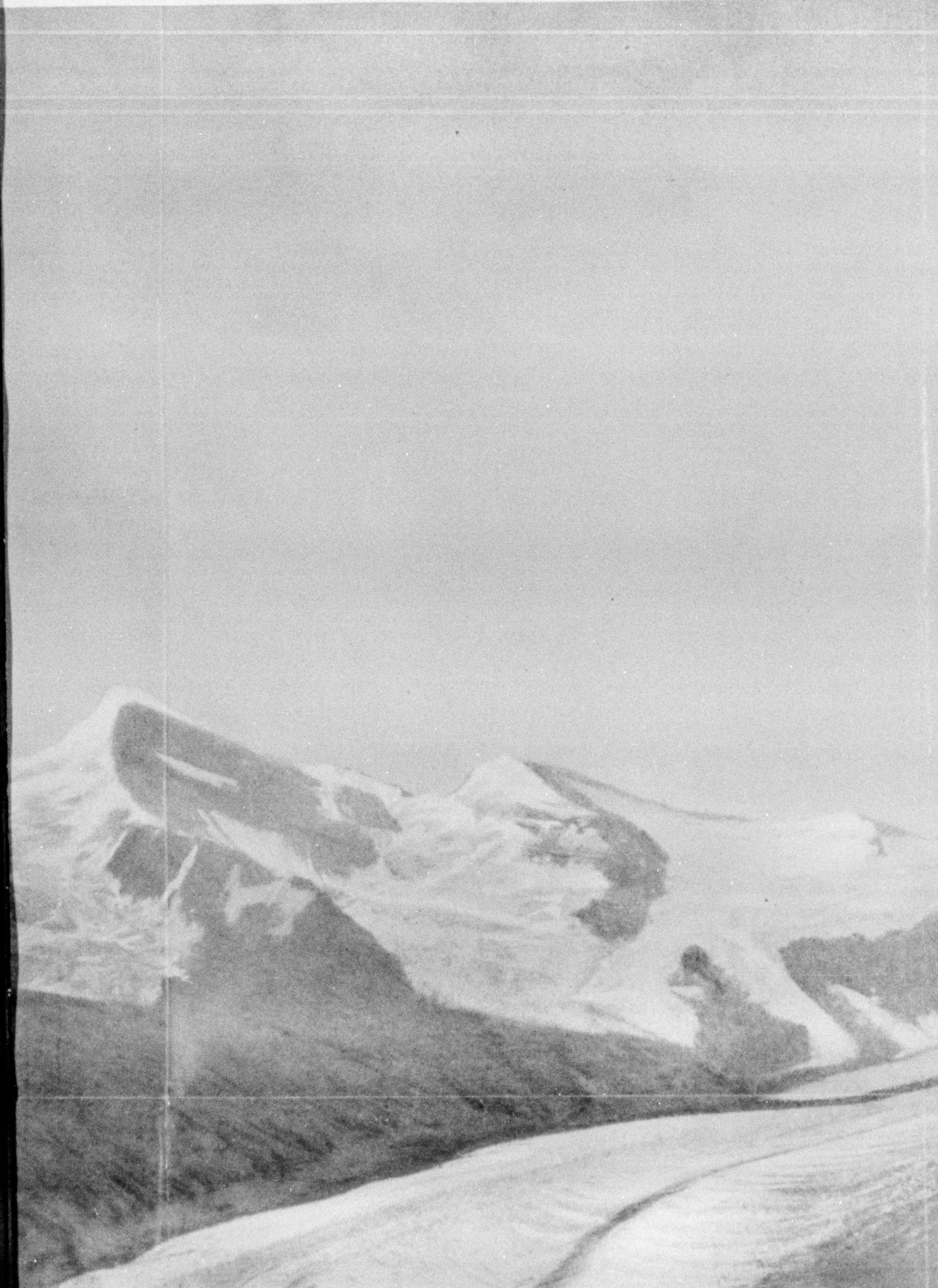
PHILLIPS MT. (9,542 FEET) HUNGA GLACIER



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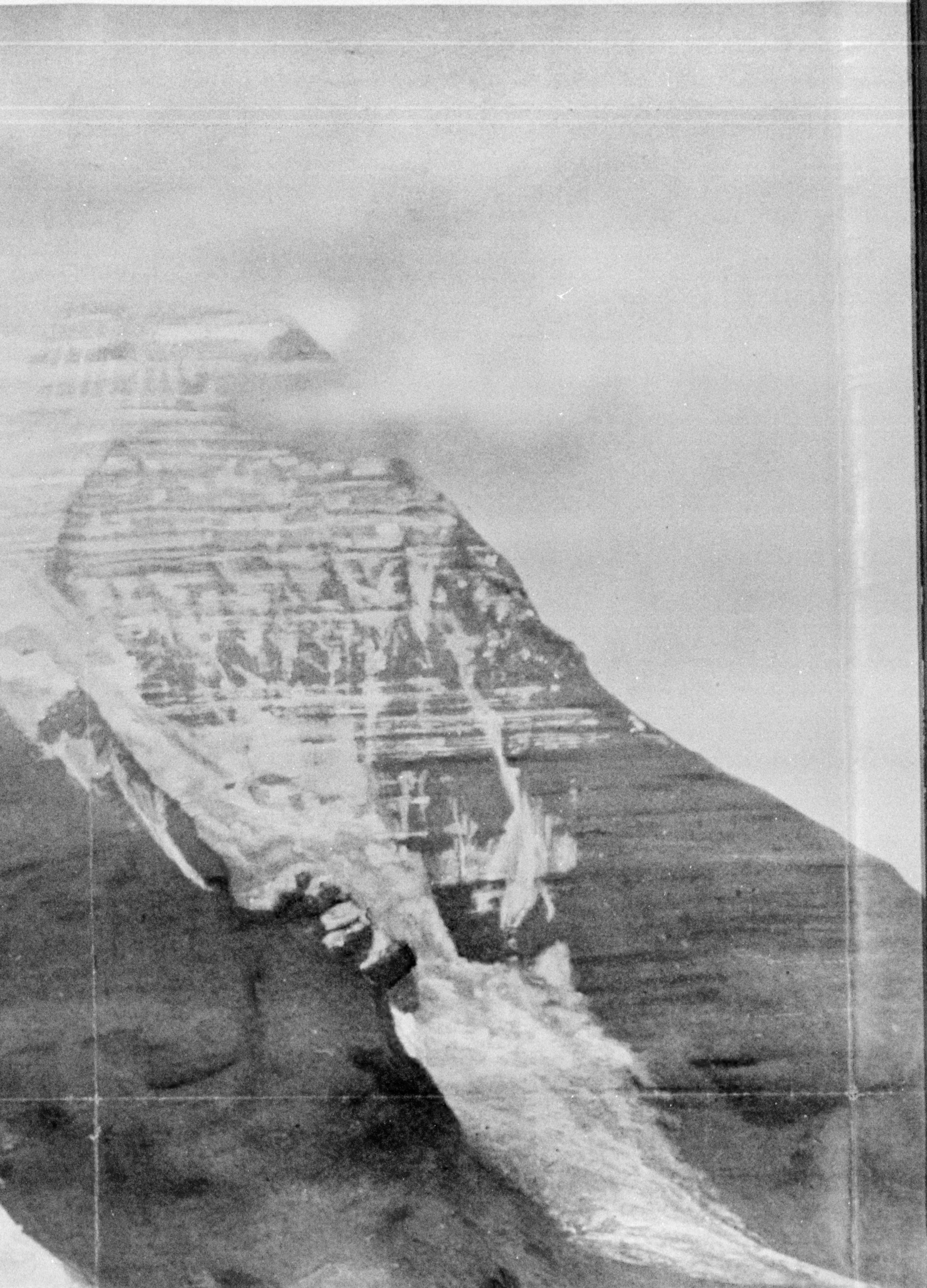
IYATUNGA MT. (9,000 FEET)

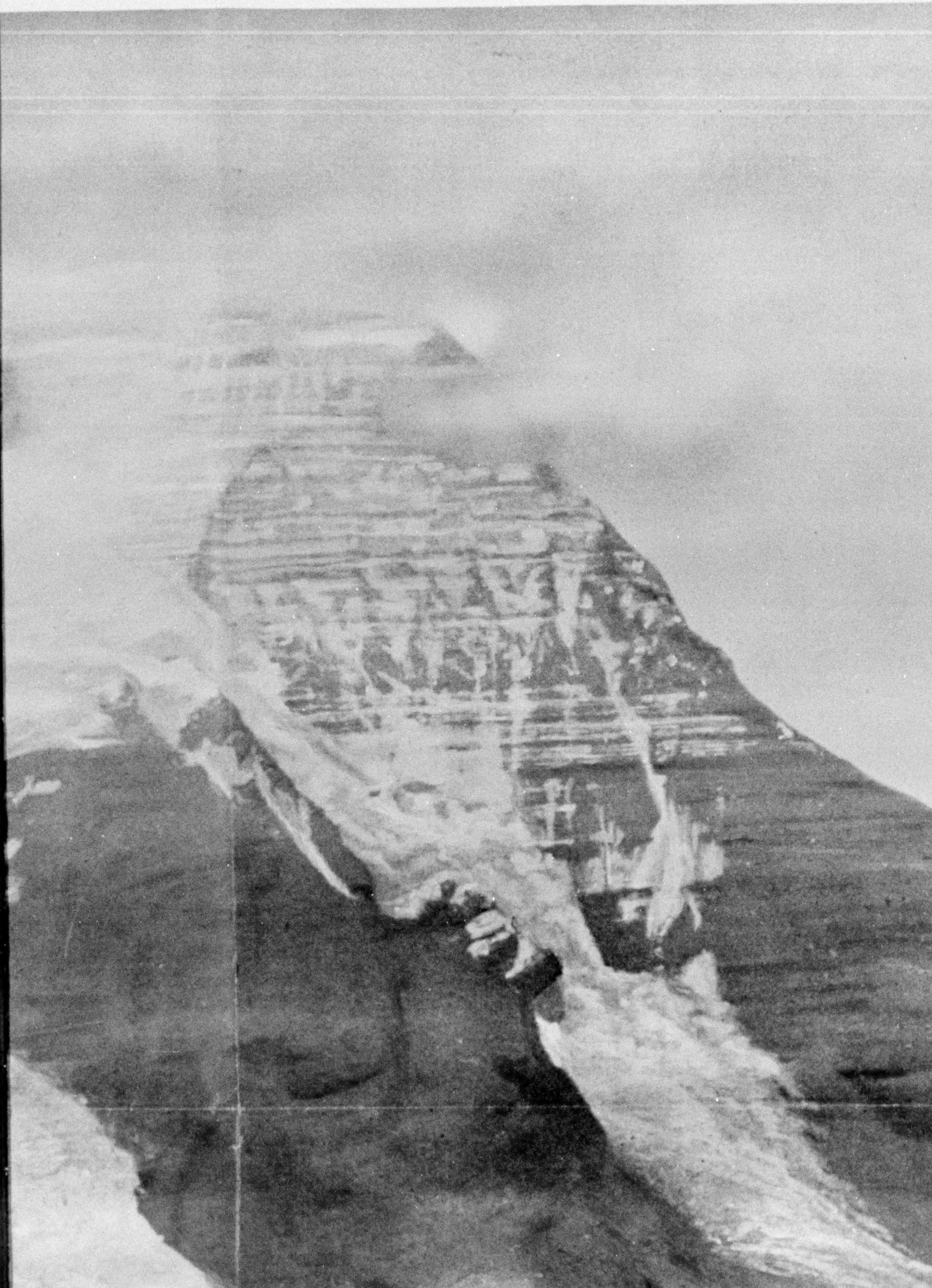
BLUE GLACIER ROBSON

BSON PEAK (13,068 FEET)

CHUPO GLACIER



ROBSON PEAK (13,068 FEET) CHUPO GLACIER



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This superb mountain pict
Hunga Glacier (on t
and Ti

ROBSON PASS (5,550 FEET)

This superb mountain picture, by Dr. Charles D. Walcott, Secretary of the S
Hunga Glacier (on the left) is a broad river of ice six miles in length. B
and Titkana (Bird) mountains form the mighty portals of I

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THE MONARCH OF THE CANADIAN RO

he Smithsonian Institution, is as unique as it is beautiful. It includes a great mountain mass, two types
h. Blue Glacier (near the center of the picture) slides and tumbles down the slope of Robson for 5,000 fe
of Hunga Glacier. The horses seen in the foreground are 1,800 feet above the Berg Lake. For further

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THE MONARCH OF THE CANAD

Secretary of the Smithsonian Institution, is as unique as it is beautiful. It includes a great mountain m
miles in length. Blue Glacier (near the center of the picture) slides and tumbles down the slope of Robs
ighty portals of Hunga Glacier. The horses seen in the foreground are 1,800 feet above the Berg Lake

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ADIAN ROCKIES—ROBSON PEAK

ain mass, two types of glaciers and a continental divide that sends the waters from the great glacier w
Robson for 5,000 feet. Chupo Glacier (on the right) brings down the blocks that determine the geologic ag
Lake. For further information about this wonderful region see the article by Dr. Walcott in this number o

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S—ROBSON PEAK

and a continental divide that sends the waters from the great glacier west to the Pacific and north
Glacier (on the right) brings down the blocks that determine the geologic age of the rocks of Robson. I
about this wonderful region see the article by Dr. Walcott in this number of the National Geographic M

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BERG LAKE (5,500 FEET)

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ic Magazine.

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BERG LAKE (5,500 FEET)

Arctic Ocean.
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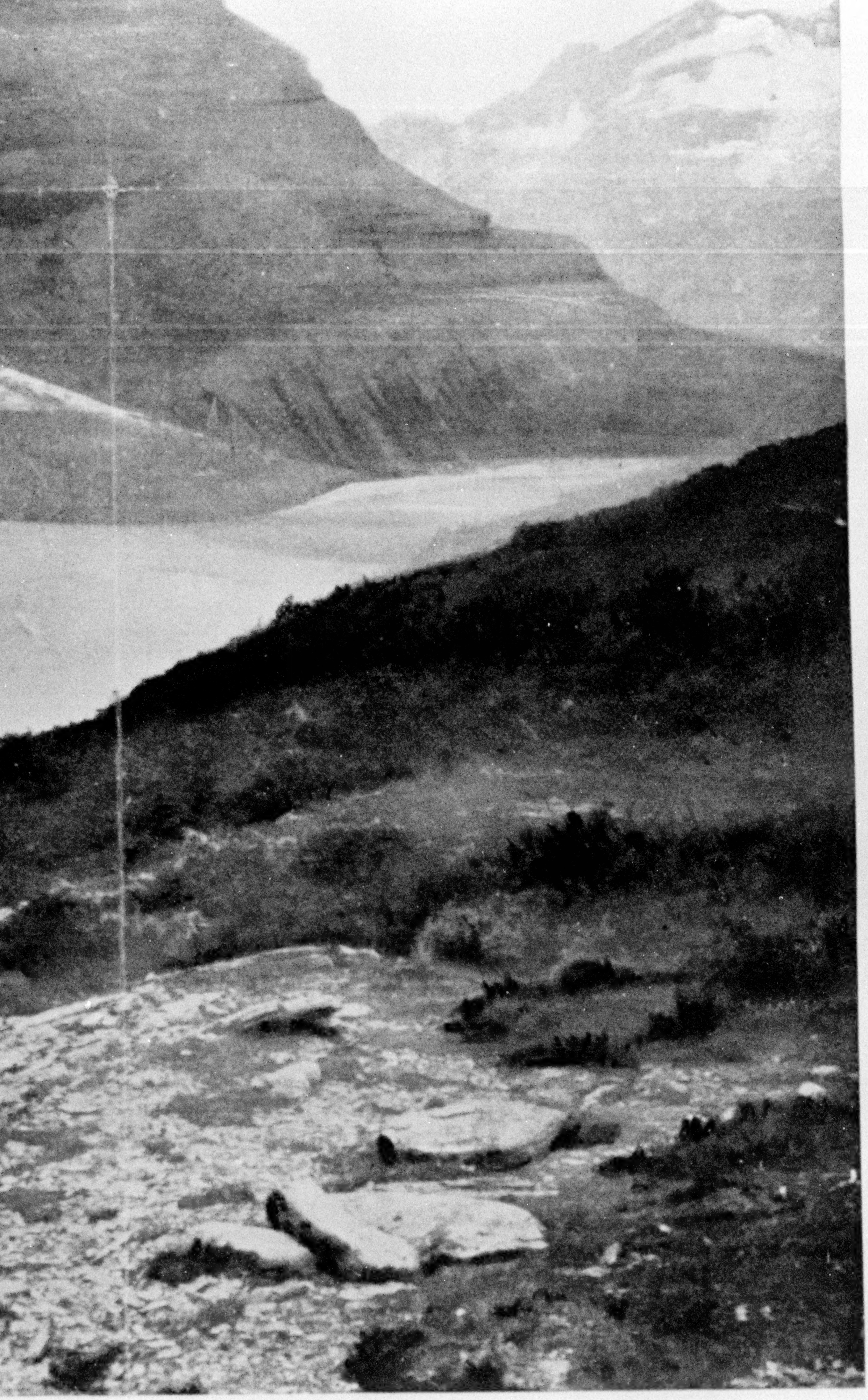

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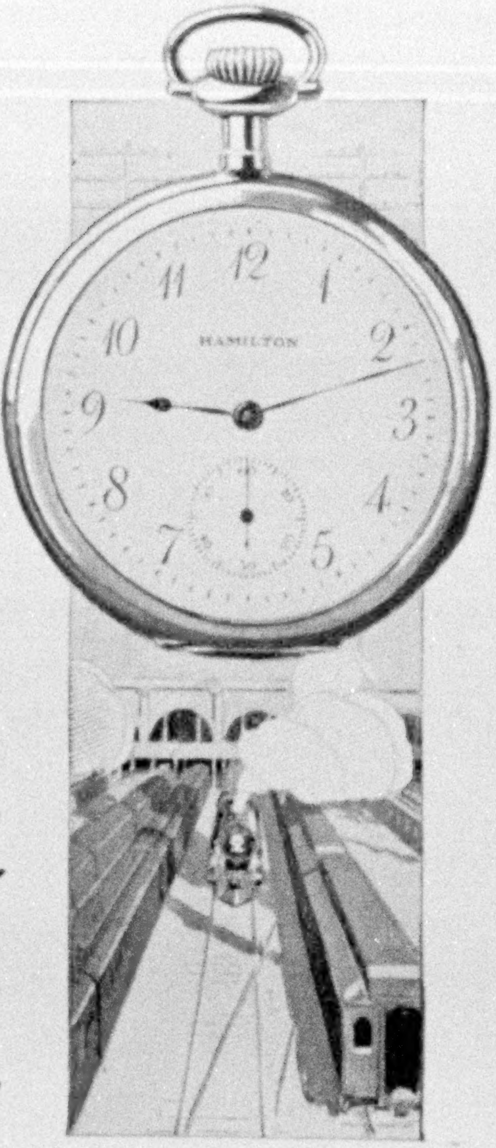

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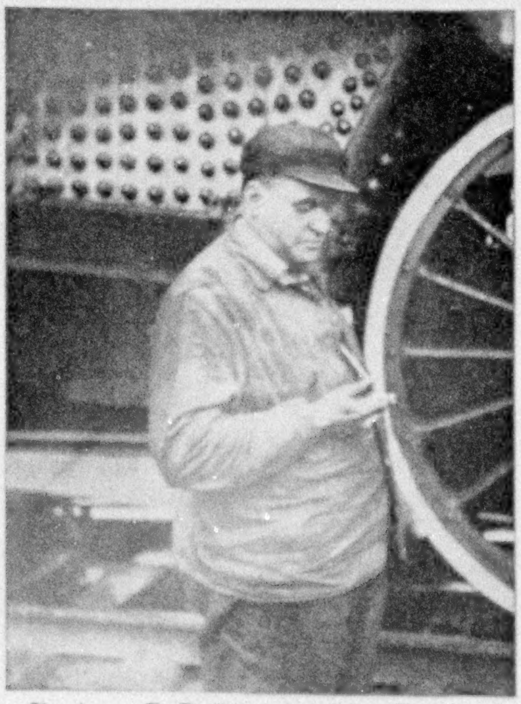

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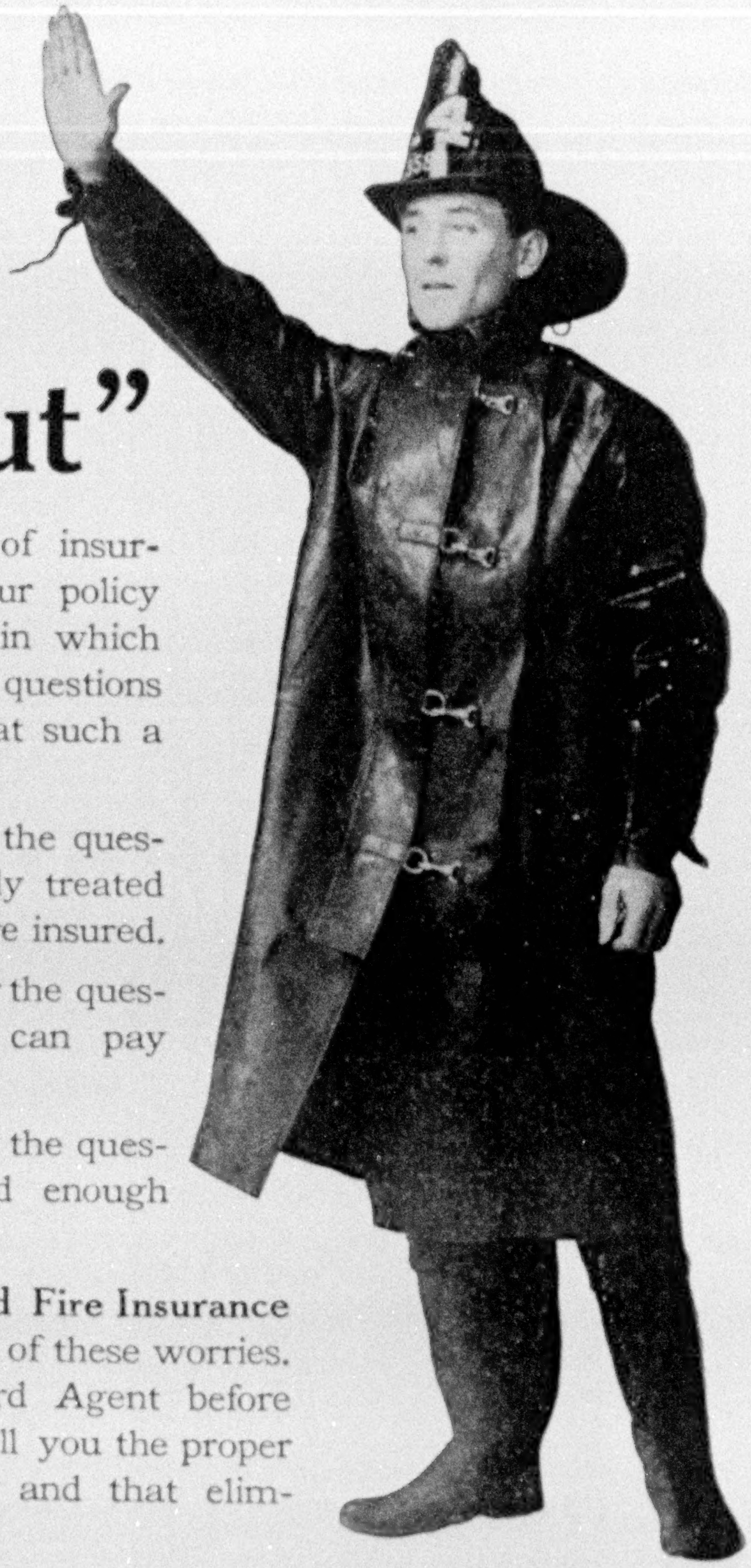

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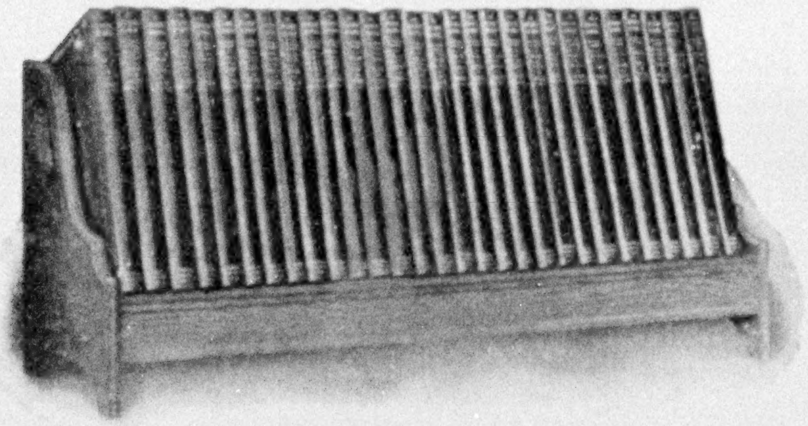

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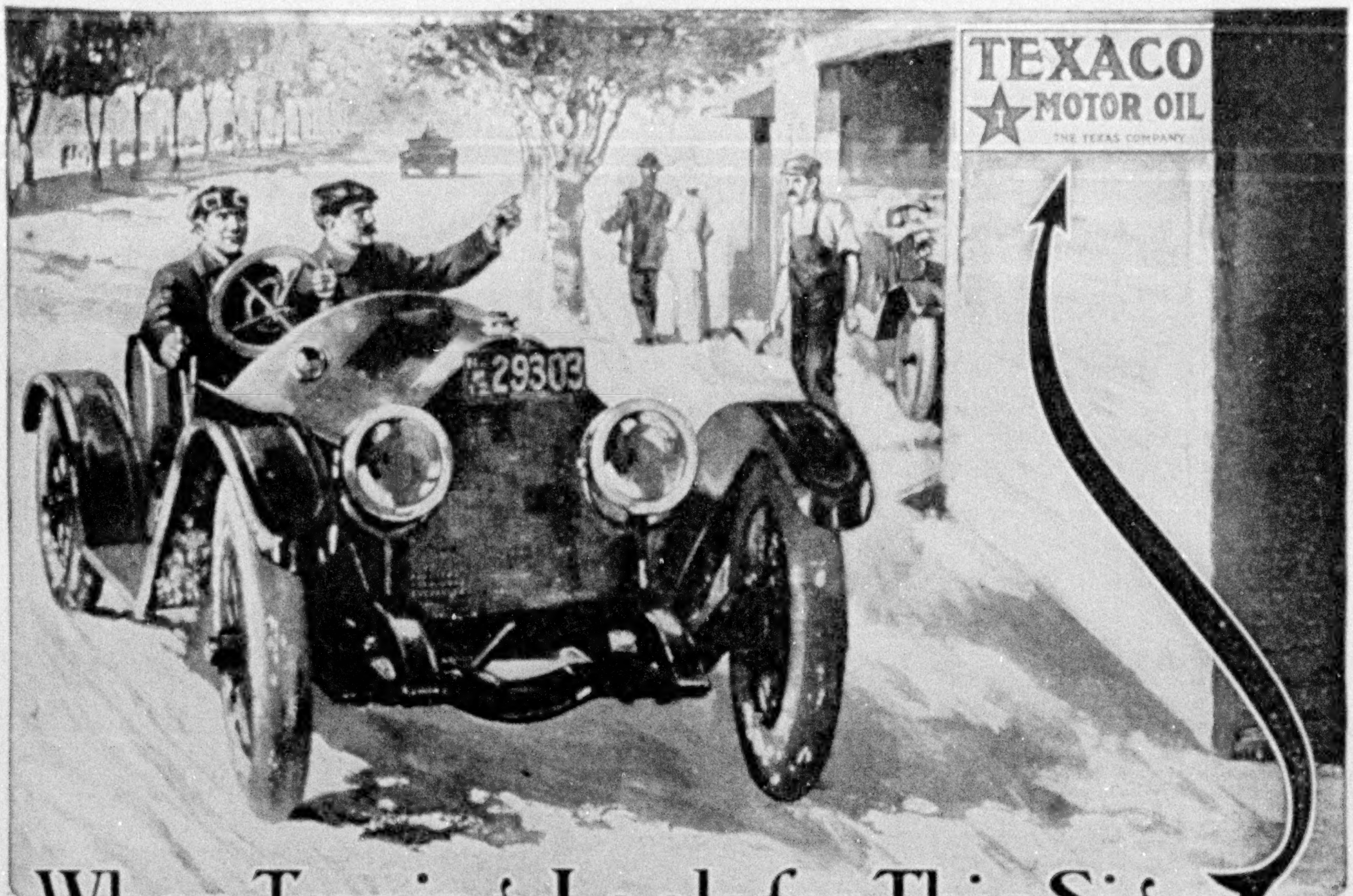

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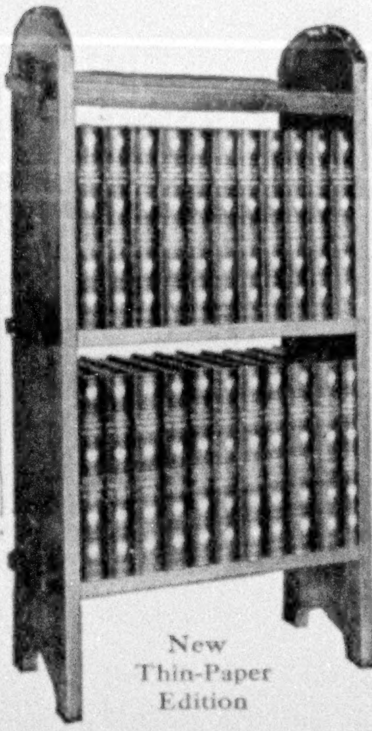

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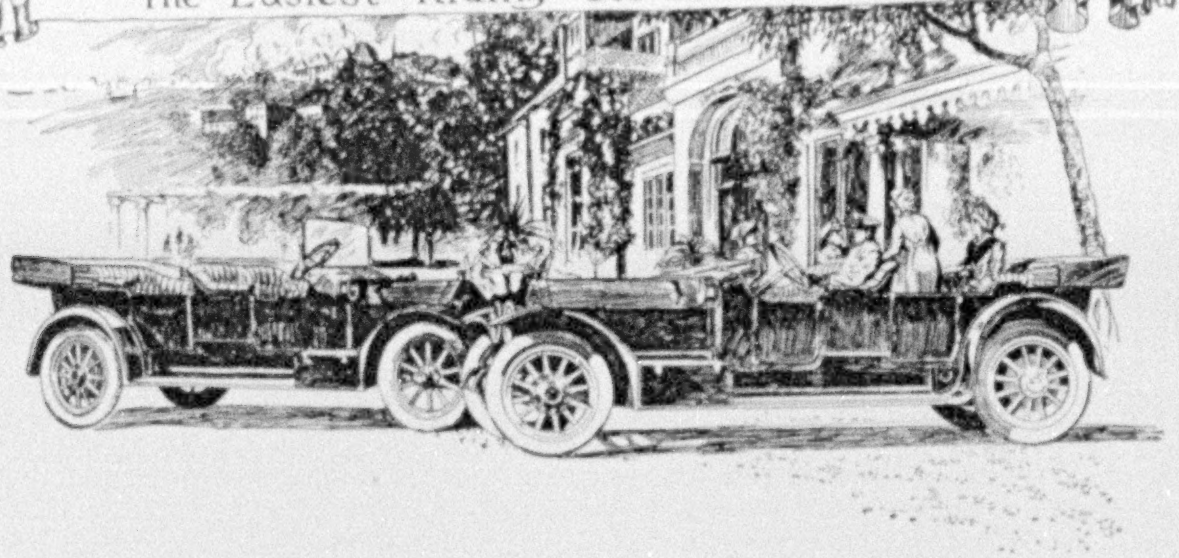

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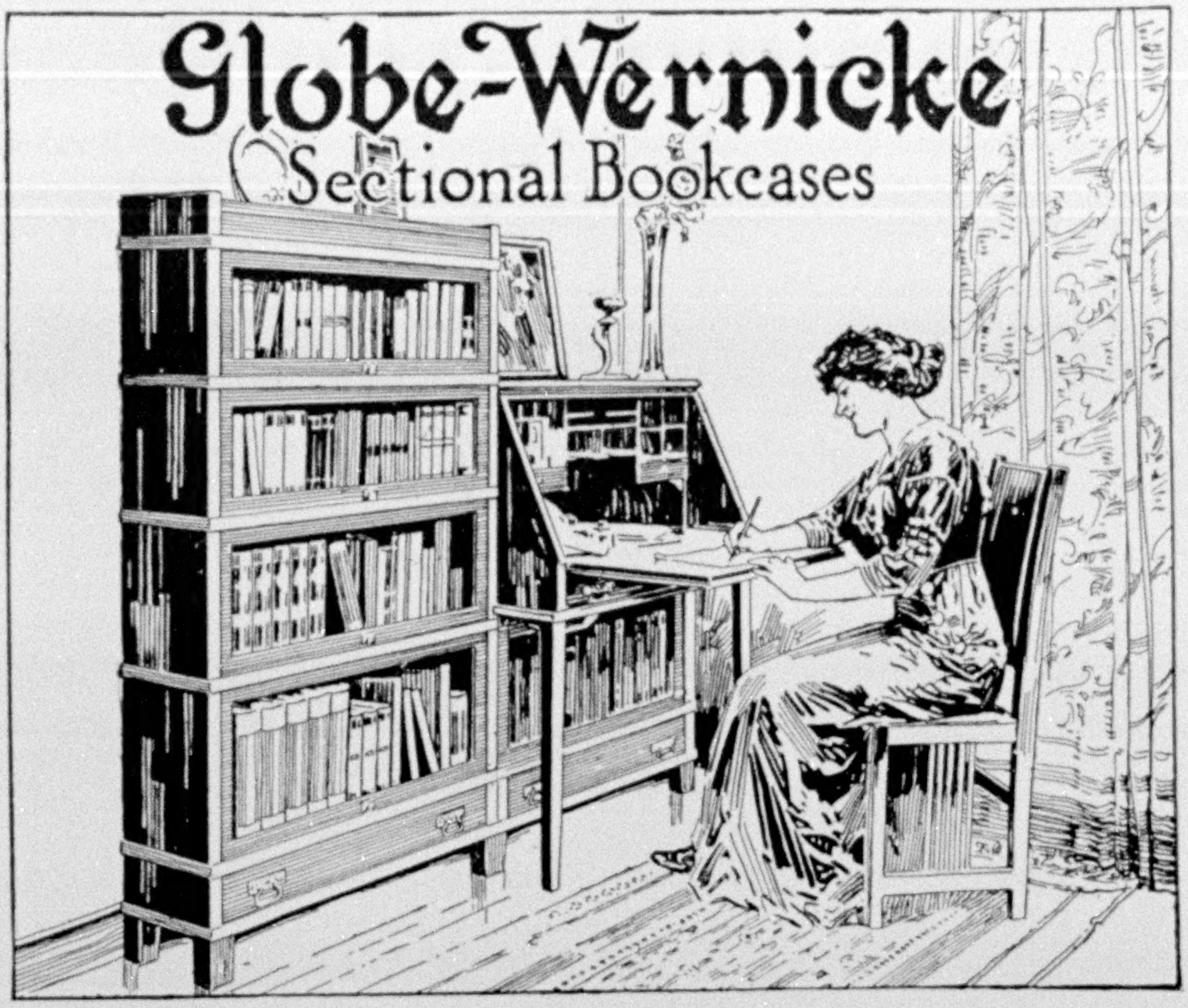

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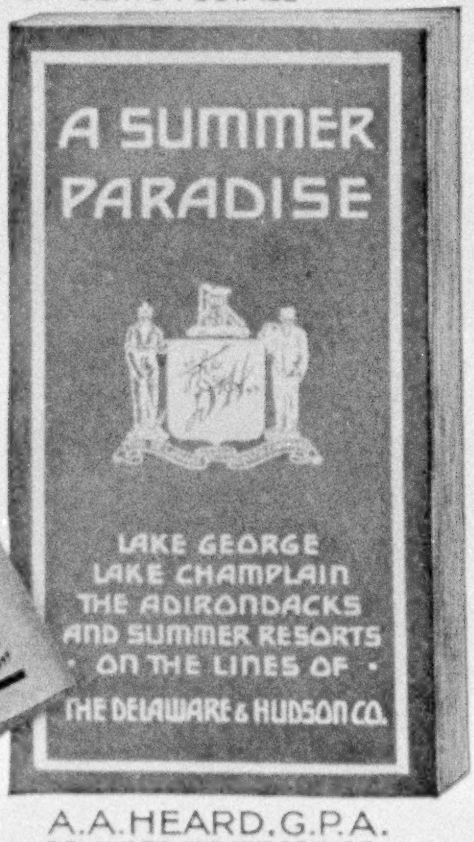

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The marvel is that the annual roster of visitors does not exceed a hundred thousand instead of being about one-fourth that number. If Emperor of Arizona I would decree that everybody passing through should pay tribute to this titanic chasm at least once. But all one can do, in this land of the free, etc., A. D. 1913, is to set up a guidepost and ask the passer-by to stop and look.

The Grand Canyon is sixty-five miles north of Williams, in northern Arizona. Williams is on the transcontinental line of the Santa Fe. There's a railroad to the rim, and a through Canyon Pullman on the California Limited.

The extra railroad fare is only seven dollars and fifty cents. Add two and a half dollars, if the Canyon sleeper is occupied. It will cost you between four and eight dollars a day at El Tovar Hotel, and about three dollars a day at Bright Angel Camp annex. The customary rim road and trail trips can be made for as little as fifteen dollars. The special camping tours cost extra and are worth the money.

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Luxurious coaches are provided for the rim drives, manned by drivers who can keep still in sixteen languages. Sure-footed mules make the trails safe, bossed by guides who can throw the most complicated "hitch," and explain everything except how the Canyon was formed.

Hermit Rim boulevard and Hermit trail, newly built, have opened up a new region.

You may have thought of the Grand Canyon only as something to look at—a mammoth panorama. It is in fact a most thrilling spectacle and an enormous one. But please remember that it also is a place for rest and recreation. Here, far from accustomed scenes, you may breathe a wine-like air and acquire an enviable tan. You may spend weeks in the saddle, camping at night in the pine forests, or on the treeless desert, or down in the big gorge.

Yet, when all is said and done, the great lure is the colorful Canyon itself.

Whether seen at dawn, at high noon, when twilight comes, or under the friendly stars, the sight fascinates you. Step to the brink, look down and across. Presto! the purple-red mystery has entered your soul forever.

The geologist can name every stratum of this gigantic layer-cake, from the top limestone down to the granite through which the tawny Colorado has cut a narrow way. He sees, as in a vision, the slow procession of geologic time. To him, in truth, a day is as a thousand years.

The artist mainly cares for the divine coloring and the infinite diversity of form and structure.

You and I perhaps will be attracted by other phases. For each person there is a special message.

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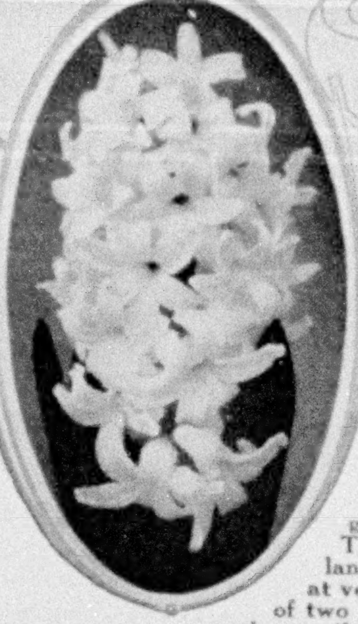

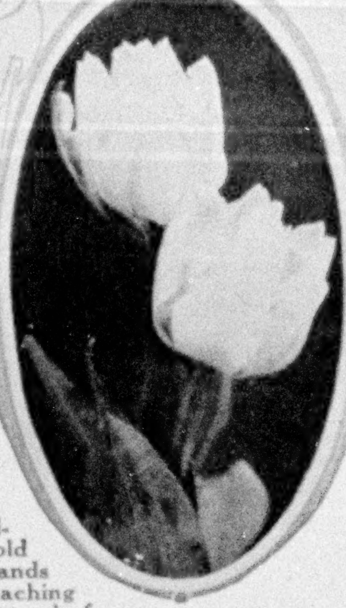

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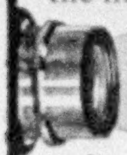

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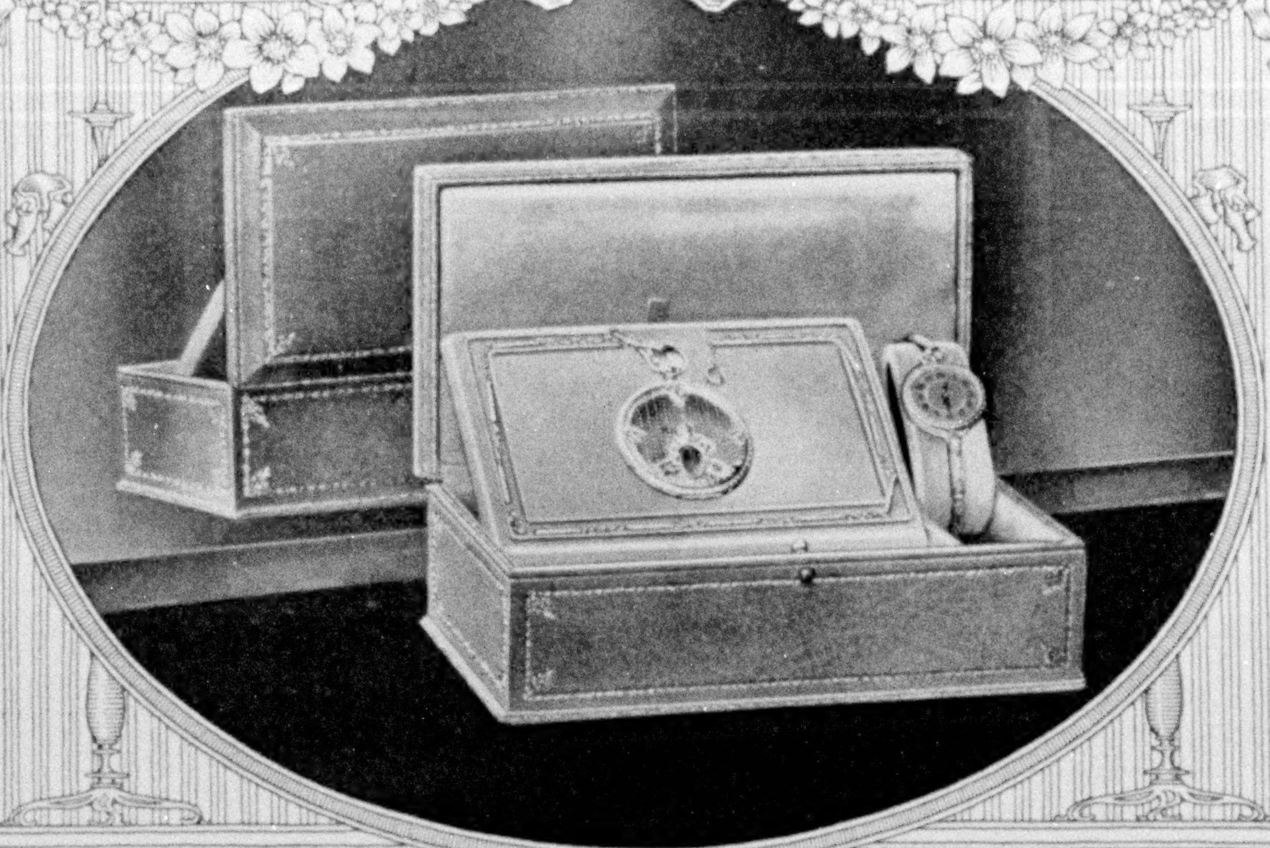

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VOL. XXIV, No. 5 WASHINGTON MAY, 1913

THE NATIONAL GEOGRAPHIC MAGAZINE

THE MONSTERS OF OUR BACK YARDS

By David Fairchild

In Charge of Foreign Seed and Plant Introduction, Department of Agriculture

Author of "Our Plant Immigrants," "New Plant Immigrants," and "Madeira, On the Way to Italy," in the National Geographic Magazine

My task is to open to the readers of the National Geographic Magazine a door into a world as full of romance as the fairy tales of Grimm or Andersen.

But first I must tell you how it came about that an agricultural explorer should dare to present a theme so far removed from the one with which his life has been associated.

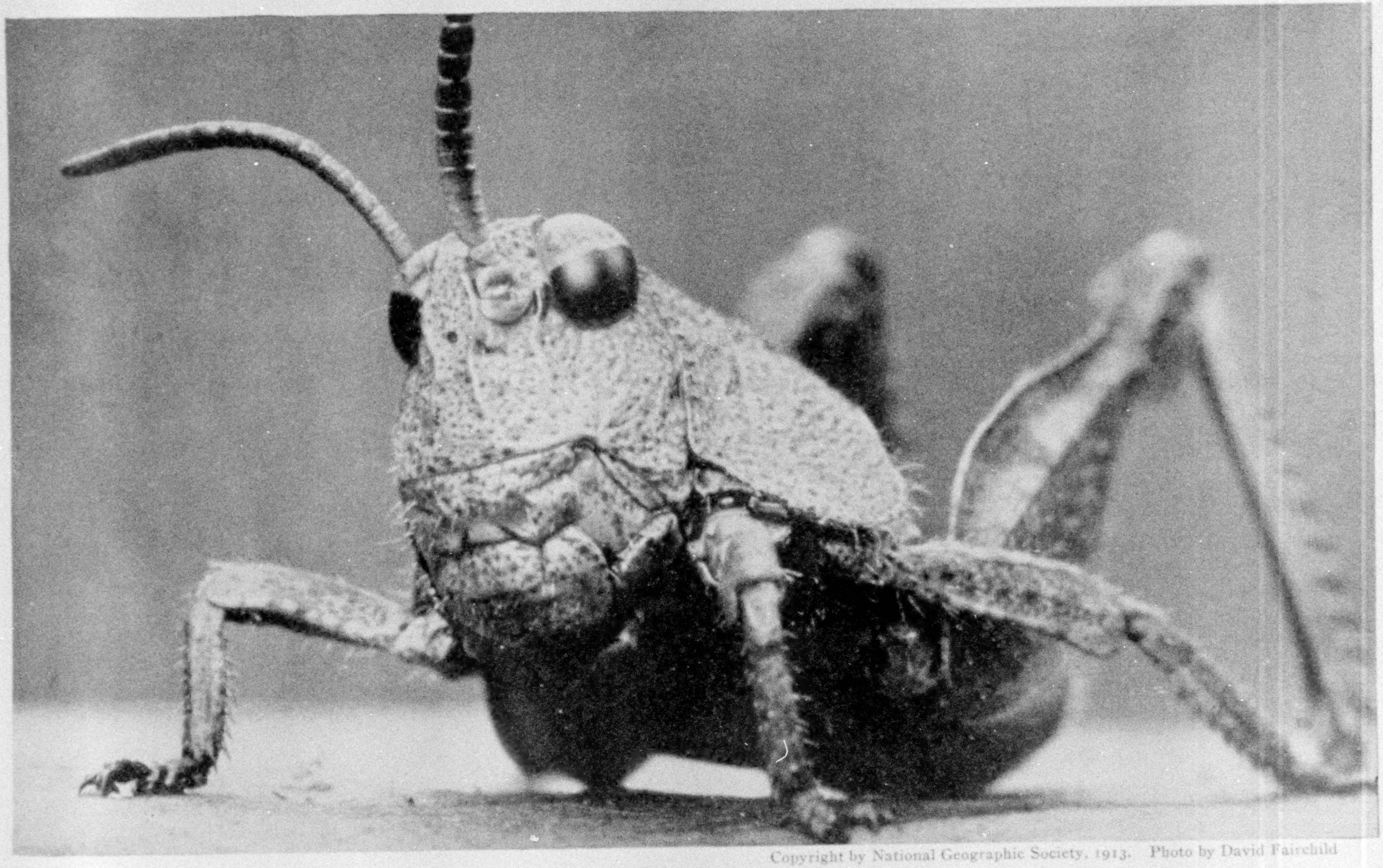
I sat down one Sunday afternoon to write a story for my little boy about the creatures which he was finding around my laboratory in the woods. He was hunting for them with the same enthusiasm that a big-game hunter stalks his game in the jungle, and the thought flashed into my mind, why shouldn't we hunt them with a camera just as Shiras and Dugmore and others have done. It is true our monsters were small, while theirs were big; but then theirs were as much too large for the photographic plate as ours were too small. They were forced to reduce the image of each beast to the limit of a five by seven plate, while we would be forced to enlarge ours to the same dimensions.

The collection of photographs which has grown out of this idea is a miscellaneous one and has been made without any thought of what would be done with it later, and it was not, therefore, until I accepted the invitation to publish some of them that I really began to look into the vast storehouses of literature which describe the life histories of these creatures.

The facts which I have been able to find out about them represent not my own observations, but those of hundreds of trained observers who, working quietly for years and some of them for a lifetime, have studied out the habits of these various forms, most of which are so difficult to study that months of patient waiting have been required to find out some significant fact about their ways of life.

I had thought, in my ignorance of the subject, that all of my beasts had names, for they were caught within a stone's throw of my house; but my entomological friends of the Department of Agriculture and of the National Museum found difficulty in identifying some which I thought must be common; and now, since I have read more fully of the vastness of the world which I had entered, I wonder that with only the mummified specimens which I had preserved they could name so many of them.

In fact, almost the first sentence in the first text-book I opened made the astonishing statement that "insects are the most numerous in species and individuals of all land animals. It is estimated that about 250,000 species have already been described and have had scientific names



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THE KING GRASSHOPPER

A representative of one of the great enemies of the human race. Down its broad throat can disappear with astonishing rapidity the green leaves which make the foods we most depend upon; and, in the past, famines which have cost the lives of thousands of human beings and consumed the fortunes of millions of them have been traced to the voraciousness of hordes of young grasshoppers like this (see page 579).

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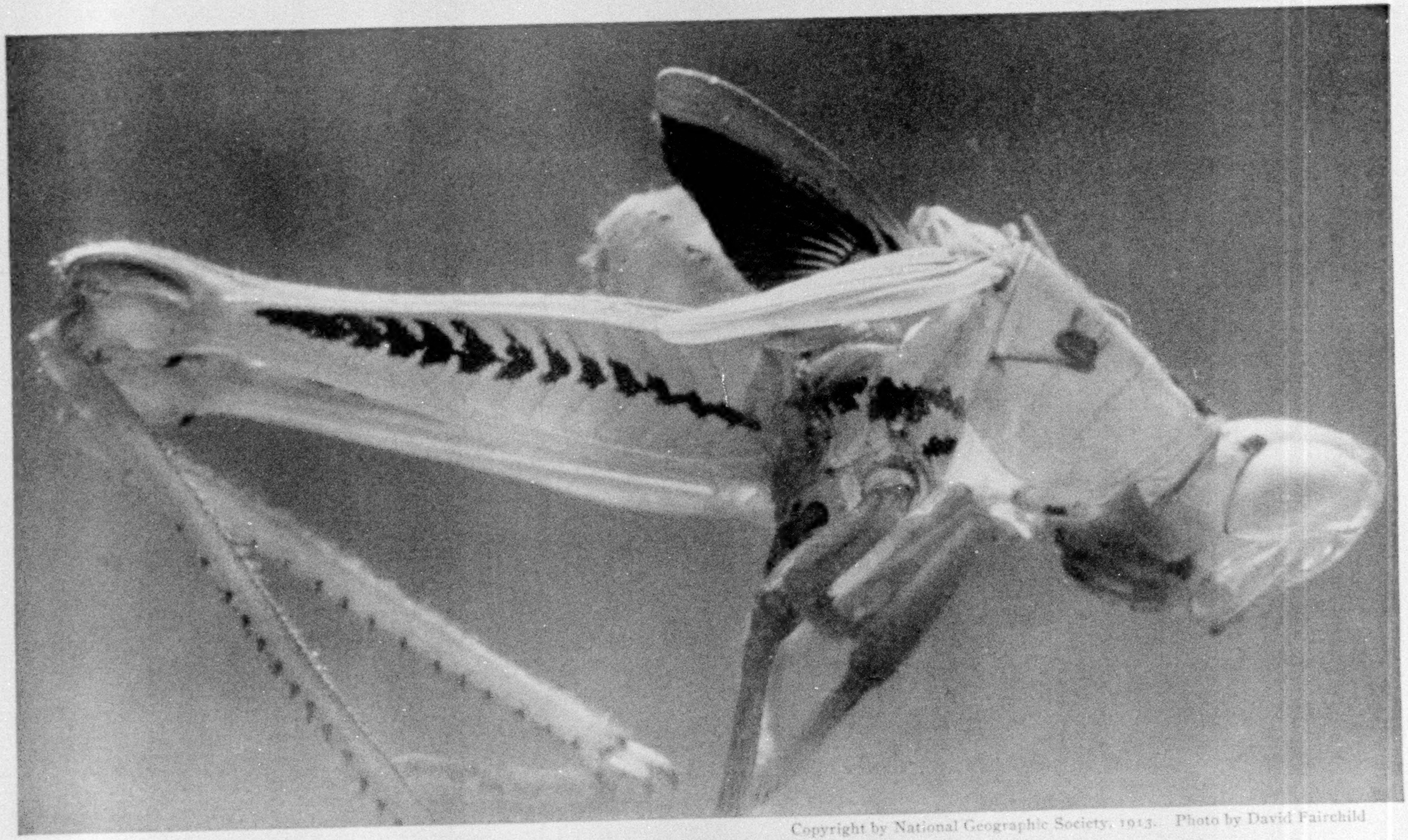
A BABY GRASSHOPPER

Unlike the beetles and the butterflies which spring full-fledged from the metamorphosis of a caterpillar, the grasshopper comes to be a winged creature by slow stages, each one a little more advanced than the former with wings a little better developed. The baby grasshopper is essentially a small, wingless adult, and not a grub or larva in the ordinary sense (see page 579).



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A YOUNG GRASSHOPPER'S SKELETON

The grass of the back yard is strewn with such skeletons as this, for every single grasshopper leaves from five to seven of different sizes in the course of his life wherever he happens to be when a moult or change of skin overtakes him in his career. Like crabs and other crustaceans, the grasshoppers crawl out of their shells or skeletons whenever in their growth these become too small (see page 579).

given to them, and it is considered that this is probably only one-tenth of those that really exist."

I must explain that all the creatures shown are not insects; for, strange as it may seem to some of my readers, spiders are not insects, for they have eight instead of six legs and no feelers or antennæ. It is a pleasure to present these monsters to the public as a showman might, on a level with the eye and not looking down on them as they are so often shown in text-books on entomology.

THE KING GRASSHOPPER (PAGE 576)

The young king grasshopper is probably 20 days old, and its wings have not developed, but it can jump a hundred times its length, whereas man can scarcely cover three times his length at a leap. When its wings grow and its internal air sacs fill with air it can sail away for miles. One representative of this great family can sail for a thousand miles before the wind, and they go in such numbers that they make a cloud 2,000 square miles in extent.

Its great front lip hides a pair of jaws as effective as a hay-chopper, and it has an appetite as voracious as that of a hippopotamus. This voraciousness and these jaws are what have made several of its relatives the plague of mankind. They multiply in such numbers as to baffle all calculation, and every living green thing for thousands of square miles disappears down their throats, leaving the country they infest desolate. The great famine of Egypt, mentioned in the book of Exodus; the grasshopper years of Kansas, which ruined thousands of families on our plains, and more recent devastations in Argentina and South Africa are examples of the tremendous effects which the migratory locusts have had upon the happiness of mankind.

As this young king grasshopper stands looking so inquiringly at one with his varicolored eyes, each of which is composed of hundreds of facets, I cannot help thinking that he represents a creature quite as fascinating and actually more dangerous than the East African monsters of our school geographies.

A BABY GRASSHOPPER (PAGE 577)

A baby creature, scarcely two weeks since it issued from a grasshopper egg, and yet with two moults behind it—two bright green baby skins cast off!

Imagine looking forward, as this baby creature does, to the day when the pads on its back shall have grown so long and parchment-like that it can leave its hopping terrestrial existence and sail away across the fields. Until that time, however, it must be content with its six springy legs, pushing its way among the blades of grass, tasting everything green and eating what it likes, and hiding from its enemies when moulting time comes round.

A young chick finds itself shut inside the egg-shell and must work its way out alone, but the young grasshoppers when they hatch out find themselves—the whole nestful—shut in a hardened case in the ground made by their mother, and it takes a half dozen of them working together to dislodge the lid which shuts them in.

YOUNG GRASSHOPPER'S SKELETON (PAGE 578)

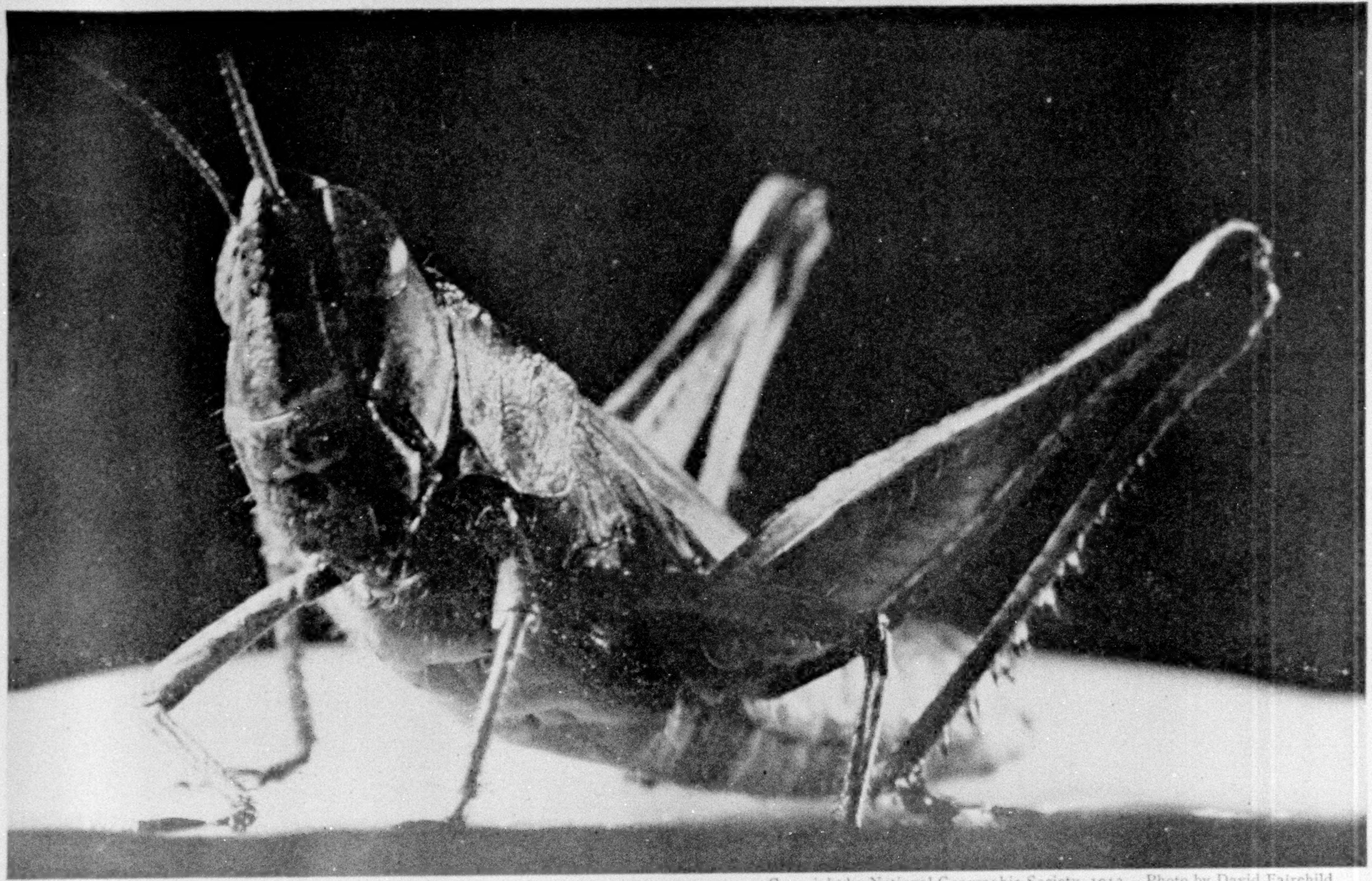
When the young grasshopper emerges from the egg, it is very small indeed—a wingless, helpless little creature, all legs and mouth.

It passes through successive ages, or stages, as they are called, each one of which is separated from the other by a moult or casting of its outer shell.

These moults take place at fixed periods, and as the insect finds itself restrained by its firm, inelastic skeleton, a longitudinal rent occurs along the back, and the insect, soft and dangerously helpless, struggles out of the old skin inclosed in a new but delicate cuticle, which takes some time to harden and color up.

Some people go to great trouble and expense to keep the baby portraits and even the baby shoes, and I cannot help wondering whether a full-grown grasshopper, leading a life in the open air, is ever interested in observing the baby skeletons which show its five stages of terrestrial life.

What an interesting collection could



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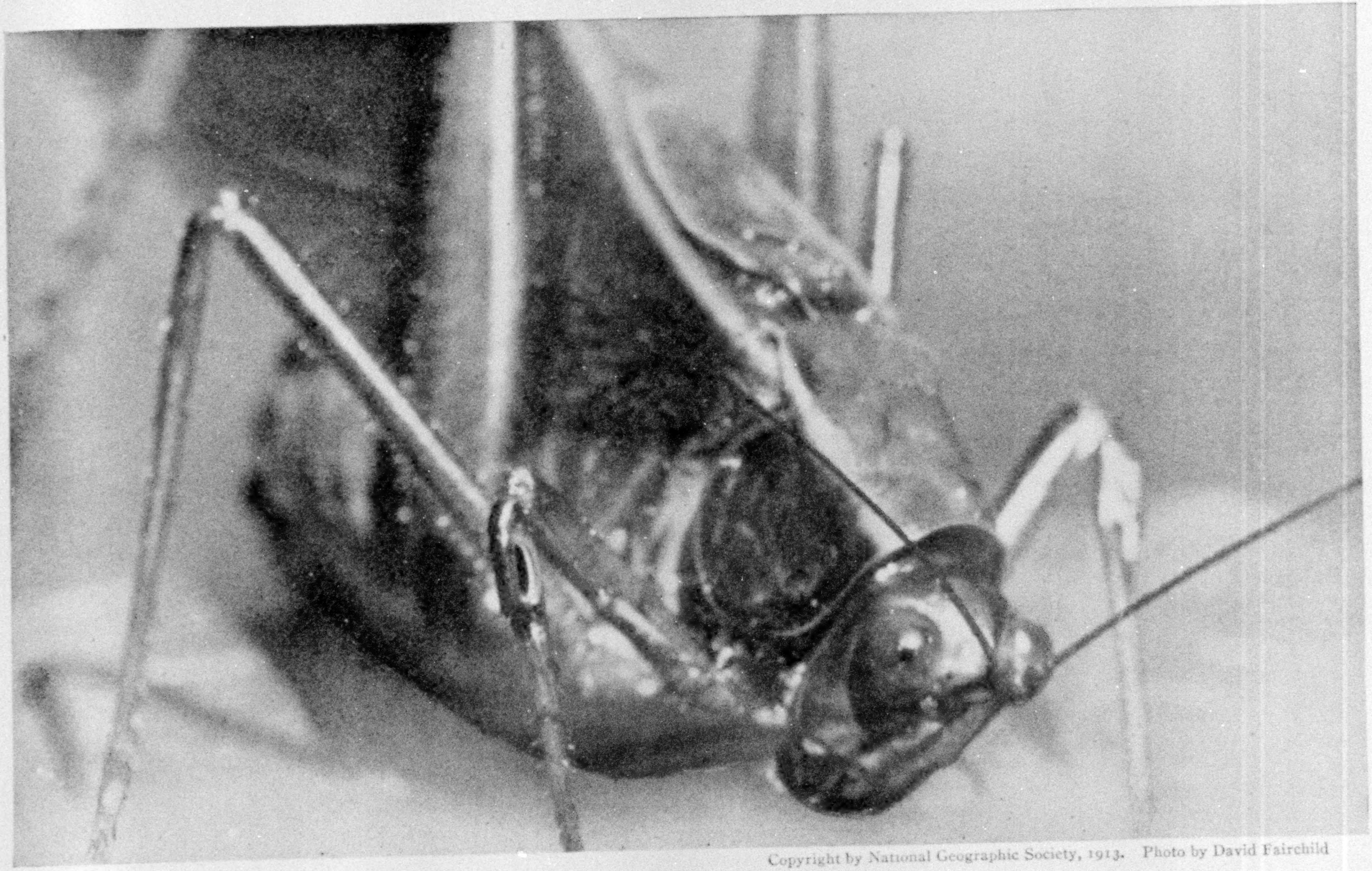
A GREEN GRASSHOPPER

For the first time in history, perhaps, we see face to face the portrait of this typical enemy of the human race, which is everywhere about us in the grass. If our jumping powers were equal to his, we could clear 600 feet at a leap (see page 583)



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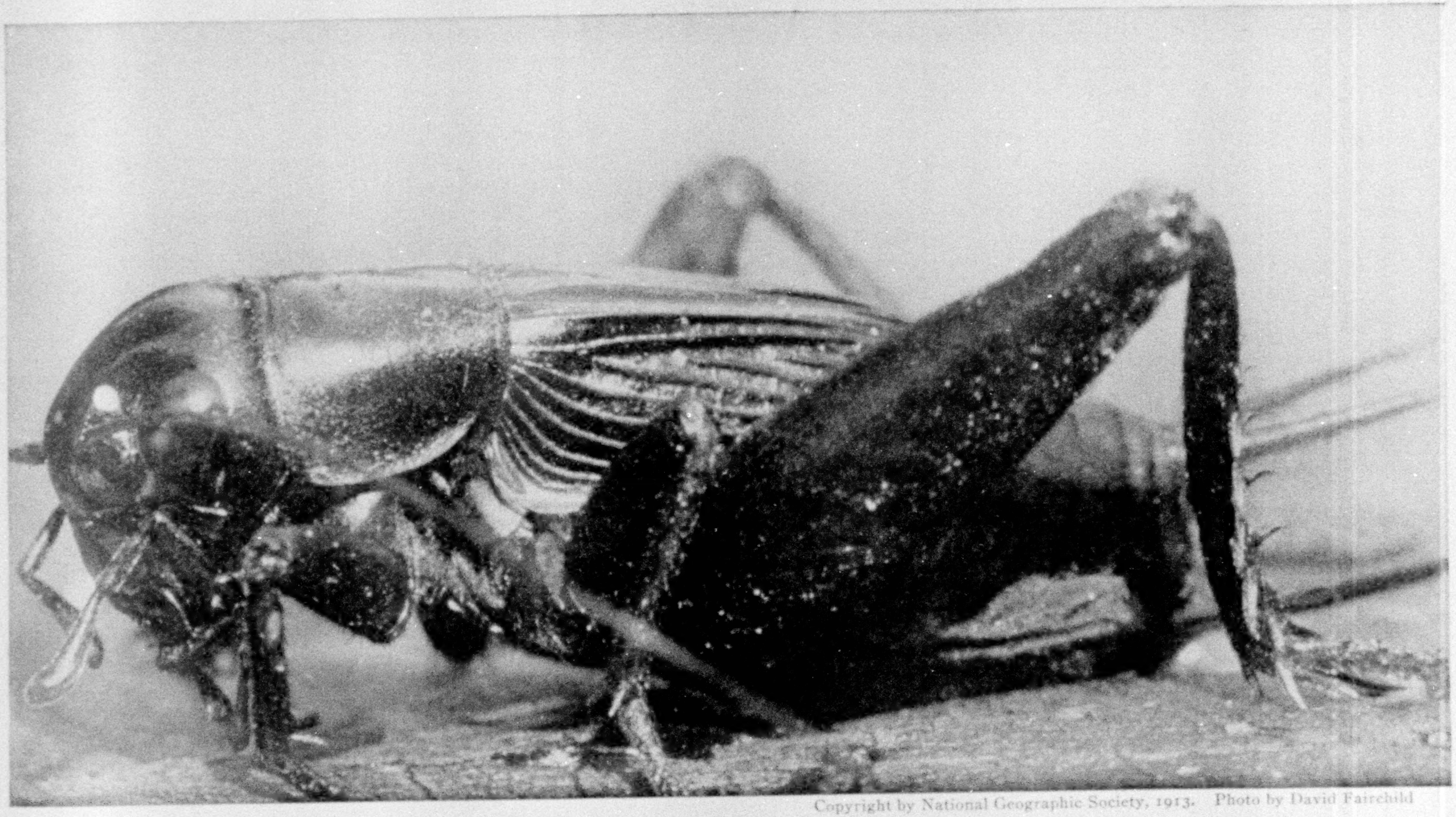
THE KATYDID

When the katydid begins its noisy summer singing, remember that it is the male calling to his mate and that she is listening with her ears, one in each front leg, just below the first knee-joint (see page 583)



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THE CRICKET ON THE HEARTH

It may be questioned whether this cricket of our firesides is not as old a member of the household of human beings as the domesticated cat or dog, and it is interesting to think that even the cave man may have listened to its chirpings in the light of his camp fire (see page 583).

be made of these insects' skeletons, photographed large enough so that we could see and study them!

A GREEN GRASSHOPPER (*Dichromorpha viridis*), PAGE 580

Whether this creature has a personality or not may be forever extremely difficult for humans to decide. Its eyes that look like cows eyes really cast a thousand images on a special kind of brain, so different from our own that we cannot understand it, and then besides these great big eyes it has three others scarcely visible in the picture. Its short-ringed horns are not horns at all, but sense organs of so complicated a nature that we do not yet know certainly whether they are organs of smell or not, and it is supposed that they may be the seat of sense organs that we humans do not have.

In front of the great thighs embedded on each side of the body, but hidden in the picture by the second leg, are the so-called ears, tuned no doubt to catch vibrations of the air far too delicate or too frequent for our ears.

The jumping legs of the creature are filled with powerful muscles, which when they expand can hurl it through the air and enable it to escape from its enemies. On the inner side, along the lower rib of the wing, is the musical instrument. It is a row of hard, bead-like projections, which are very highly developed in the males, but not at all in the females. When the edge of the wing is scraped over these projections, a musical sound is made. It would seem to be the case, as with so many of the birds, that only the male can sing, the female being mute.

THE KATYDID (*Scudderia furcata*), PAGE 581

How marvelously equipped such a creature as this is to live! The great eyes, with many facets, enable it to see by night as well as by day. Its long, slender antennæ catch the faintest odor, and probably are sensitive to a host of perfumes that we do not know. In the front of each fore leg, just below the knee, is a dark sunken area, the ear, with which it can probably hear sounds too faint for our ears, and by moving them can tell from which direction the sounds come. Its long muscular legs enable it to jump great distances, and its wings not only enable it to fly well, but in the males are provided with an apparatus near their base for making a musical sound.

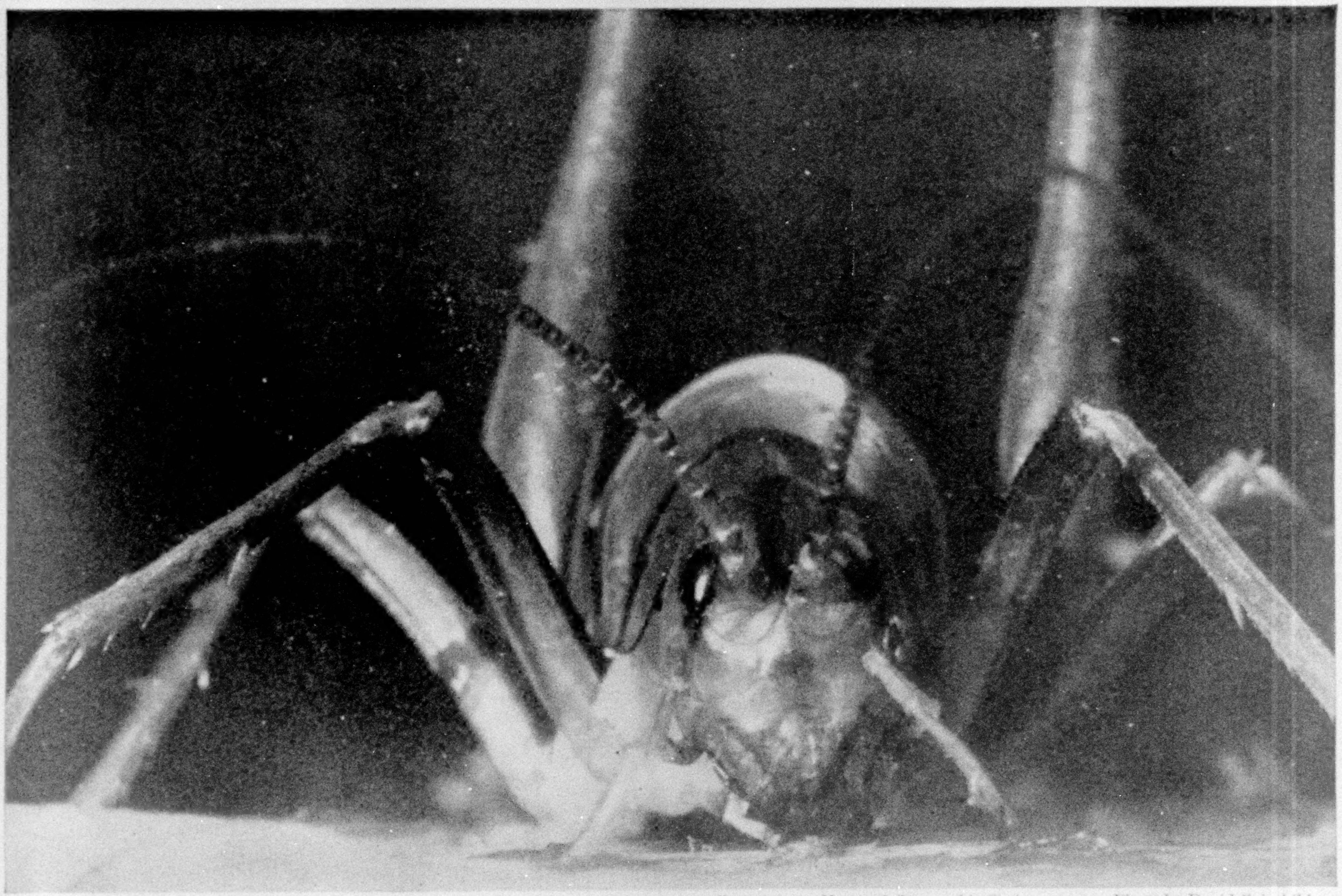
In fact, if it is any comfort for sleepless ones to know it, the katydid is one of the noisiest creatures of its size in the world. It is only the males which call their "Katy-did, Katy-didn't, she did, she didn't," and they are calling to their mates.

THE CRICKET ON THE HEARTH (*Gryllus Pennsylvanicus*), PAGE 582

Through the ages, who knows if not from the times of the cave dwellers, this friendly visitor of the fireside has rubbed his rough wings together over his head and sung man to sleep. The European form seems quite as domesticated as the cat or dog, leading nowhere a truly wild life, and it may be questioned whether any living creature has become more a part of human life than the cricket on the hearth.

The carrying power of their song is extraordinary; there are species whose strident notes can be heard for a mile, although their little bodies are scarcely more than an inch in length. The males alone are musical, and it is reasonable to suppose, since the females have ears in their fore legs, that they are singing to their mates and not to mankind.

As one listens to their friendly song it is hard to appreciate what fighters they are among themselves, the larger ones even turning cannibals when food is scarce, although a glance at the photograph shows how well equipped they are for battle. Their great black eyes only shinier black than their coal-black armored necks, their jointed palpi with which they feed themselves, their thick, leathery wings pressed against their sides like a box cover, and their strong, muscular spiny hind legs, with which they jump a hundred times their own length,



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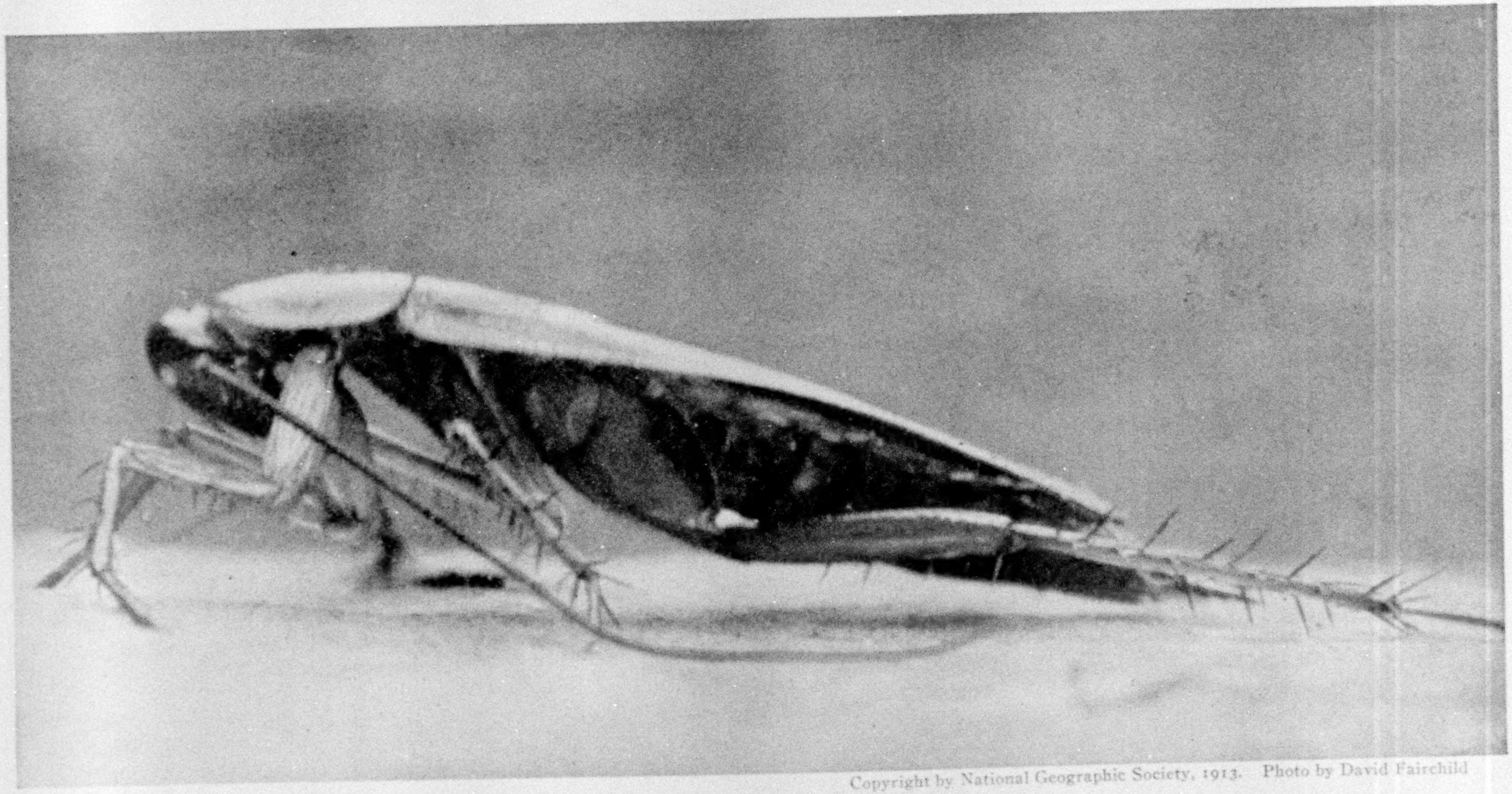
THE STONE OR CAMEL CRICKET

A tawny, long-legged creature of the night, with great dark eyes, which catch the faintest glimmer of light, and long antennæ, which feel in every direction. I wonder if it jumps at night as it does by day when you discover it under a decaying log. In reality it is about an inch long (see page 587).



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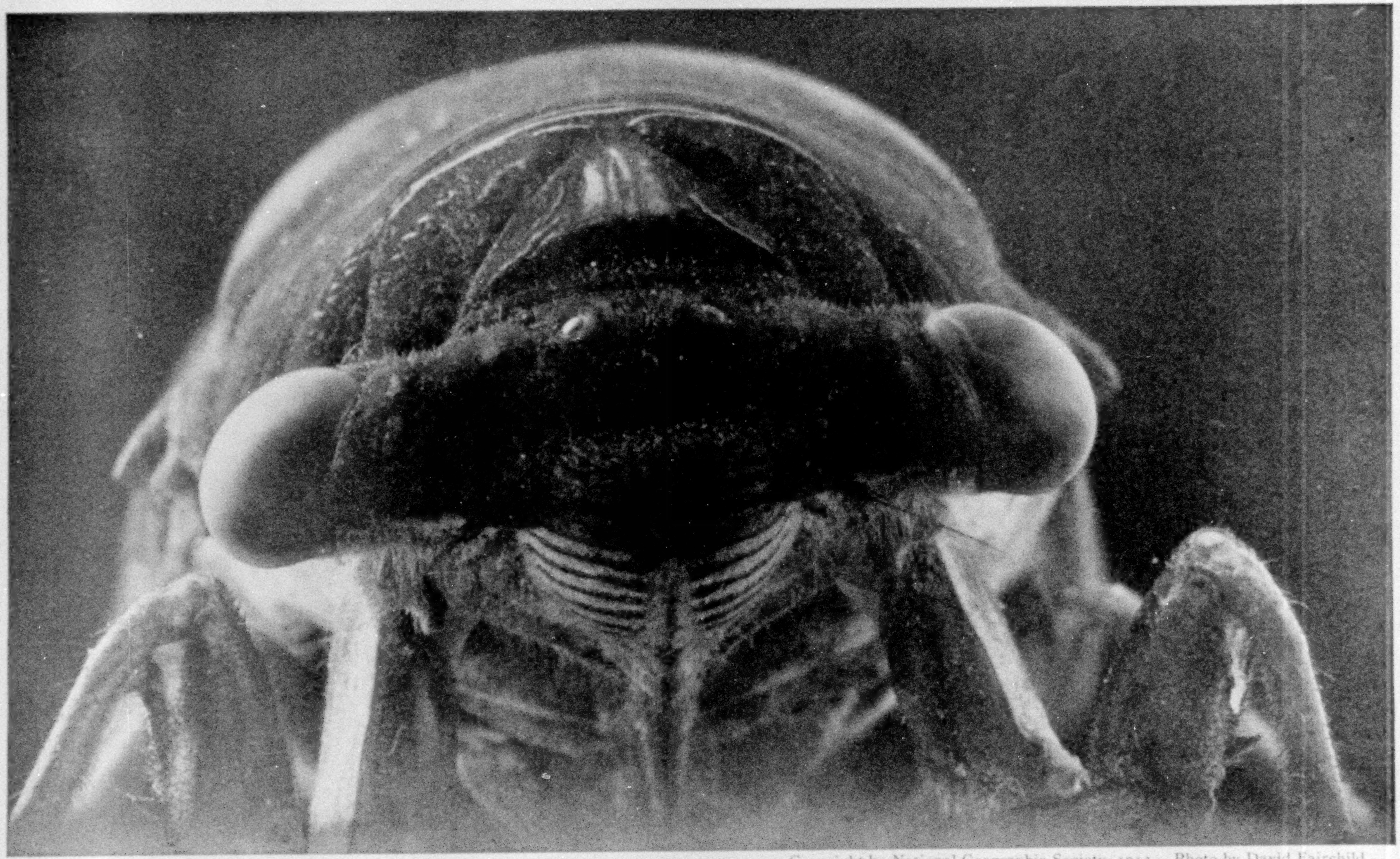
THE COCKROACH

The detestable night visitor of the kitchen whose presence is an indication that somewhere crumbs of food or grease or something of the kind is left about. No wonder, with such spiny legs as these, it can crawl anywhere and everywhere, and with hundred jointed feelers it is quick to scent the presence of its food. What diseases may it not bring into our houses? (see page 587).



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THE CICADA

A close relative of the 17-year locust, this summer lyreman, or cicada, has come to be as much a part of our summer lives as the swallow. The smooth oval knobs at each side of the head are thousand-facet eyes; two of the three lense-shaped eyelets, or ocelli, are visible half way between the facet eyes. These ocelli have three lenses in them. The antennæ are short bristles extending at an angle outward from below the facet eyes. The knees are like the knees of a crayfish's legs. The throat is slitted, and altogether it is a weird monster. Its other life below the ground is quite as strange (see page 587).

do none of them contribute to beauty, though quite in keeping with their armored war-horse appearance.

Two long flexible circi protrude like tails behind, but the task of finding out what they are for has been too difficult for man. Perhaps the strange nerve-ending hairs which they bristle with may be sensitive to vibrations of the air, of which we yet know nothing.

THE STONE OR CAMEL CRICKET (*Ceuthophilus uhleri*), PAGE 584

It would not be a good idea to let the children think that creatures such as this were prowling round the house at night—that is, unless you assure them that it is only a harmless, tawny yellow stone-cricket from the shady woods, where it generally hides under stones and damp, decaying logs.

It seems strangely equipped for its night life, for it has antennæ as long as its body. I cannot help wondering if these help it to jump in the dark. Fabre, the great French entomologist, has tried, as others have, to find out just how the insects use their antennæ and what they are really for. He says at last "our senses do not represent all the ways by which the animal puts himself in touch with that which is not himself; there are other ways of doing it, perhaps many, not even remotely analogous to those which we ourselves possess."

THE COCKROACH (*Blatella germanica*), PAGE 585

In carboniferous times this was a dominant creature, crawling over the giant club mosses and tree ferns which composed the marshy vegetation of the young world. Today it crawls over the cracker-box and makes its way through every crevice in the kitchen and is of all the creatures of our houses the most detested. This is the German cockroach, an importation from Europe, which has spread around the world and which New Yorkers know as the croton bug.

Its long, spiny legs are built for the scurrying for which it is noted, while its slippery body enables it to squeeze through crevices and holes. It carries its head tucked under its body, as if looking for food, and its whip-like antennæ, always in motion, detect at long range the presence of anything edible which can be crammed into its capacious crop.

Housewives may be surprised to learn that a cockroach can live five years, and that it takes a year to develop to maturity from the egg. The female lays her eggs in a horny capsule like a spectacle case, which she carries about with her until she is ready to deposit it in some suitable place. Later she returns to help her cockroach babies out of their shells.

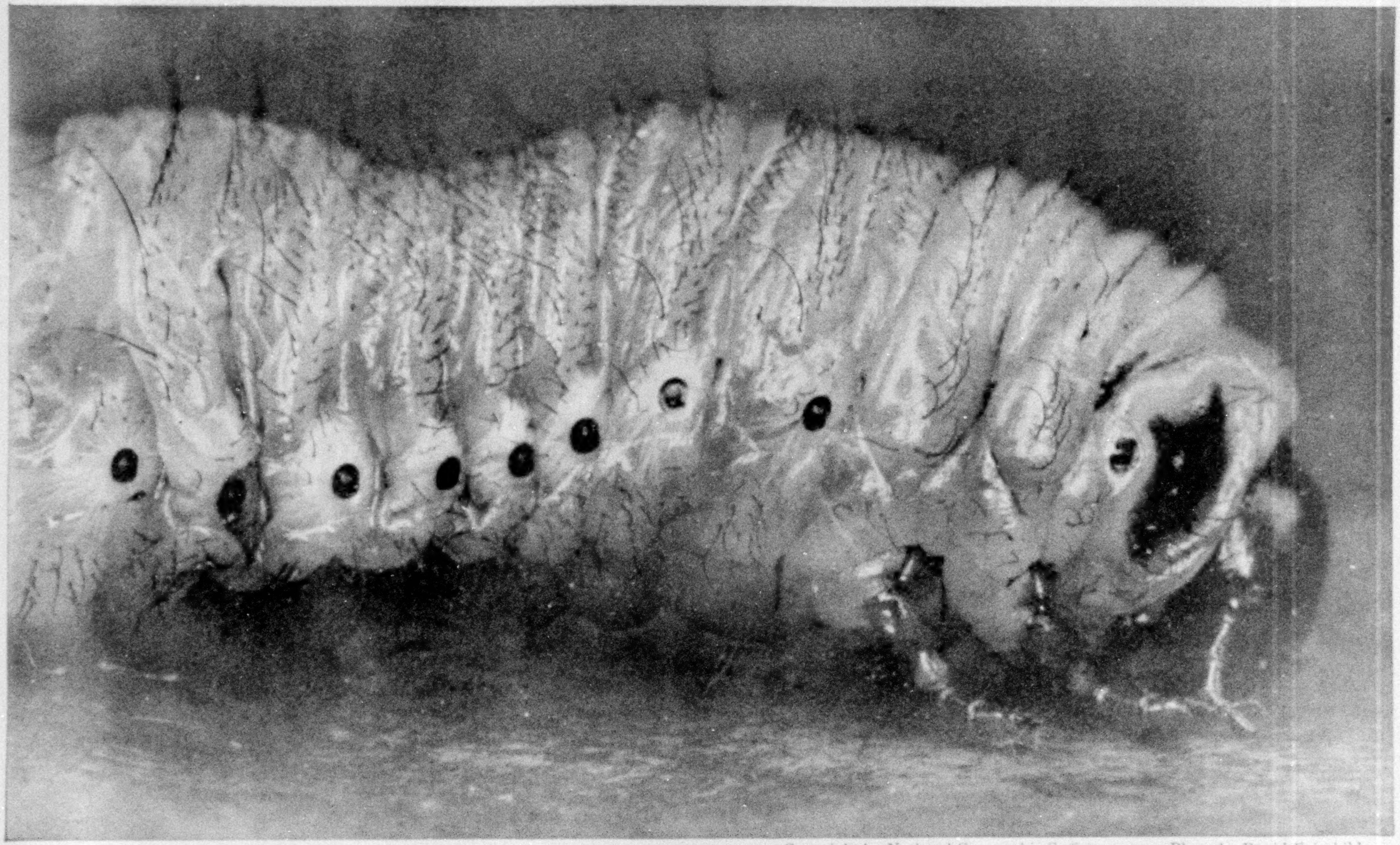
Like the crickets, cockroaches love the night and shun the daylight. They cannot tolerate cold weather, and though there are 5,000 species they mostly inhabit the tropics, where they are the plague of domestic and ship life. It is said that "ships come into San Francisco from their long half-year voyages around the Horn with the sailors wearing gloves on their hands when asleep in their bunks in a desperate effort to save their finger-nails from being gnawed off by the hordes of roaches which infest the whole ship" (Kellogg).

And now a rumor comes to us that the cockroach carries cancer.

THE CICADA (*Cicada sayi*), PAGE 586

The coming of the swallow is scarcely more significant to Americans of the Southern States than the arrival of the cicada. Its song is the noisiest song in the insect world. Darwin describes how on the *Beagle*, while a quarter of a mile off the coast of South America, he heard a tropical cicada singing. Whether we like their note or not, it is one of the shrillest and most peculiar sounds in the world. It is made in a curious way, by the stretching and relaxing of a corrugated drum-like membrane in the side of the abdomen of the creature under its wings. This is done by means of specially strong muscles. The sound is controlled in rhythmic cadences by means of semicircular discs or covers to the drums, which can be closed and opened at the will of the insect.

This noisy song, which the male alone can sing, he doubtless sings for his mate



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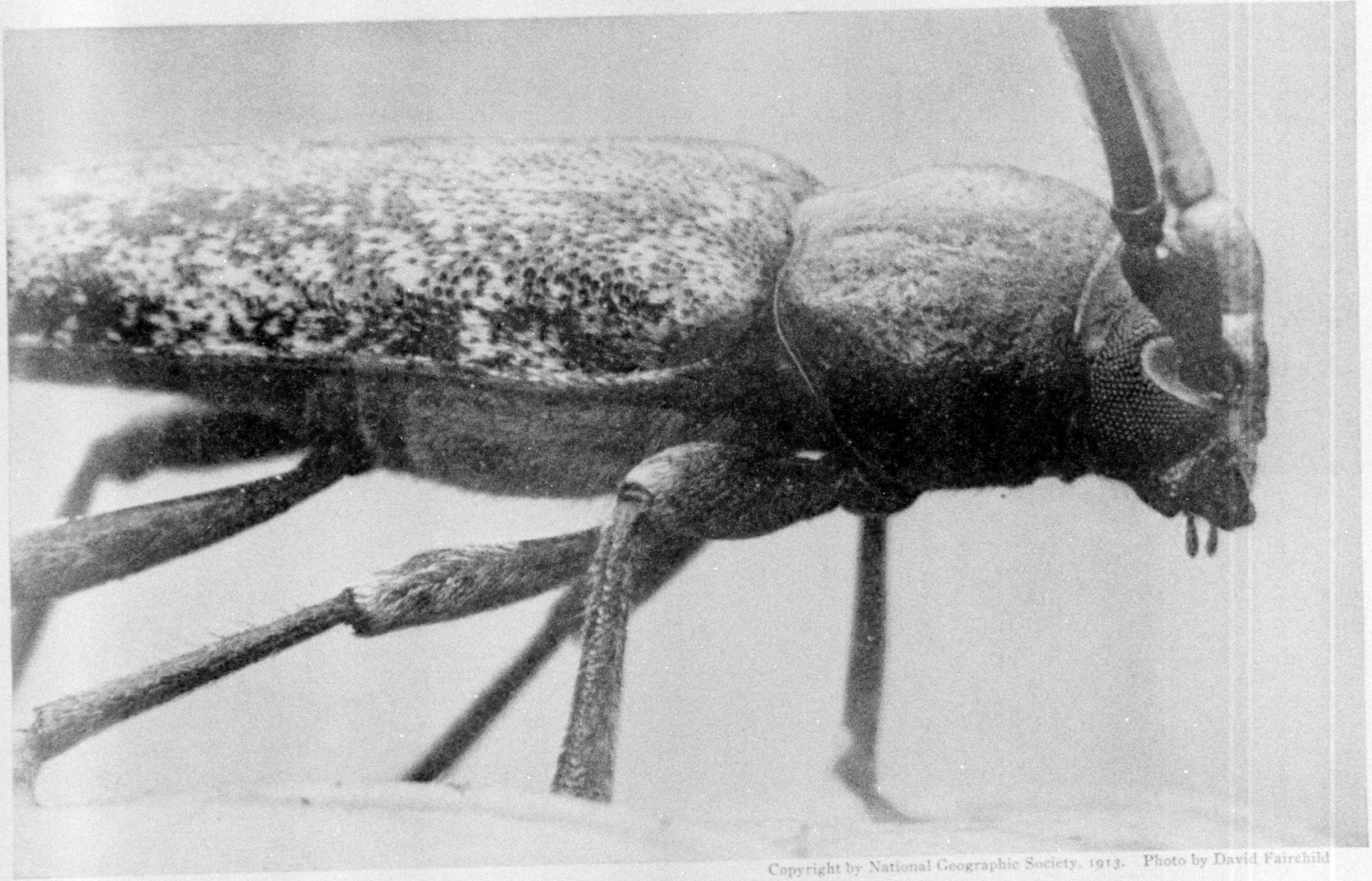
THE JUNE-BEETLE LARVA

This clumsy, helpless creature, with its rows of breathing pores and short functionless legs, has fattened for weeks like a pig on the leaves of trees, and is now nearing the stage when its internal organs will break down completely and certain active groups of cells will start to build up out of the material of the disintegrated ones the beautiful emerald green beetle (see page 591).



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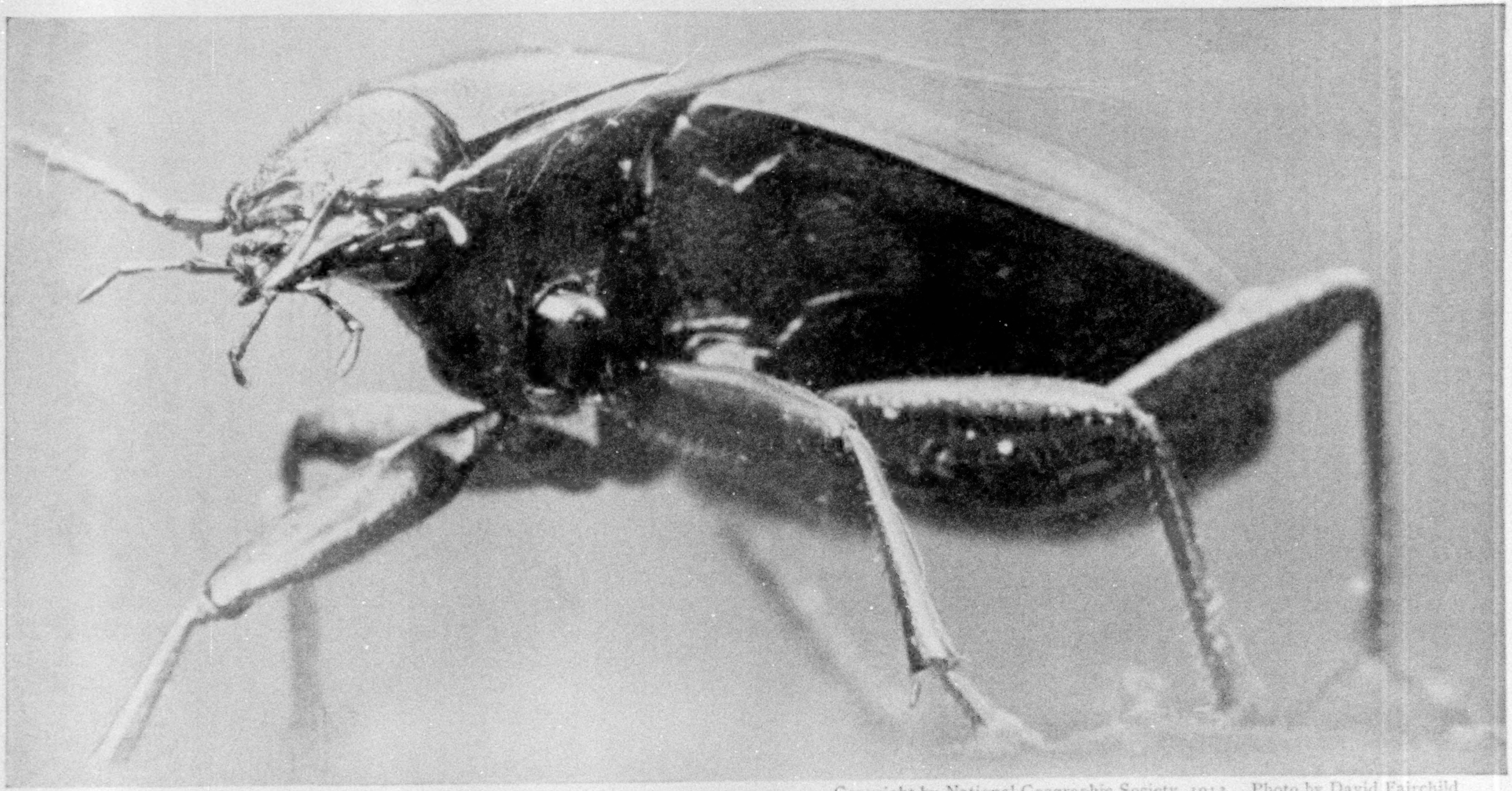
ONE OF THE TWIG-PRUNERS

Representative of a large group of beetles whose larval existence is as subject to the laws of instinct as falling bodies are to the laws of gravitation. They kill the twigs they burrow in and the wind blows them to the ground at the proper time for the larvæ to crawl into the ground and turn into the mature beetle (see page 595).



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THE PREDACEOUS GROUND-BEETLE

Every one has turned over a log or a stone in the meadow and seen come out from the hollow which it made a black-brown, swiftly running beetle, perhaps without once knowing that it looked at all like this fierce creature, which in the twilight hunts about for plant pests and devours them (see page 595).

and not for us, although entomologists are not agreed as to how his partner hears his song, as she seems to have no ears. Although this is not the strangest species of this wonderfully interesting genus of creatures, the story can be told here of that weirdest of all the insects—the Rip Van Winkle of the insect world, as David Sharp has called it, the 17-year cicada.

From a tiny egg laid by its mother in a twig of your back-yard shrubbery there issues a creature which is as unlike this monster as it can be, with soft white body and mole-like front legs. It hurries to the ground and disappears beneath its surface sometimes to a depth of a hundred times its length—20 feet it is said. For 17 years it digs its way around in the absolute darkness of this underworld, and then, as though by some prearranged agreement, it comes to the surface to join in a marriage revelry of a few brief weeks in summer with its kinsmen of the same generation who disappeared as it did into the darkness 17 years before. But somewhere while beneath the ground the mole-like creature has become transformed from the lowly larva to the strangest actively walking pupa imaginable, and when it issues from its grave, as it were, and climbs to some conspicuous branch or tree trunk, it is a full-fledged creature of the air, though encased still in grave-clothes of parchment; but it soon splits these up the back, pulls itself out, dries its powerful wings, and flies away with the whirr of an aërodrome.

Most insects live for a few months only, and one, indeed, the male at least, for only 15 or 20 minutes; but the 17-year cicada, the oldest of the insect world, lives as long as a cat or a dog. But what a life! Seventeen years of it in the dark and a few weeks in the sunlight. And yet, compared to the life of an angleworm, condemned to the darkness forever, what an interesting career.

When the cicada's shrill song disturbs you, then remember how brief is the pleasure of its existence.

This species in the photograph is more fortunate than the 17-year one, for it is condemned to only two years of darkness.

THE JUNE BEETLE LARVA (*Allorhina nitida*), PAGE 588

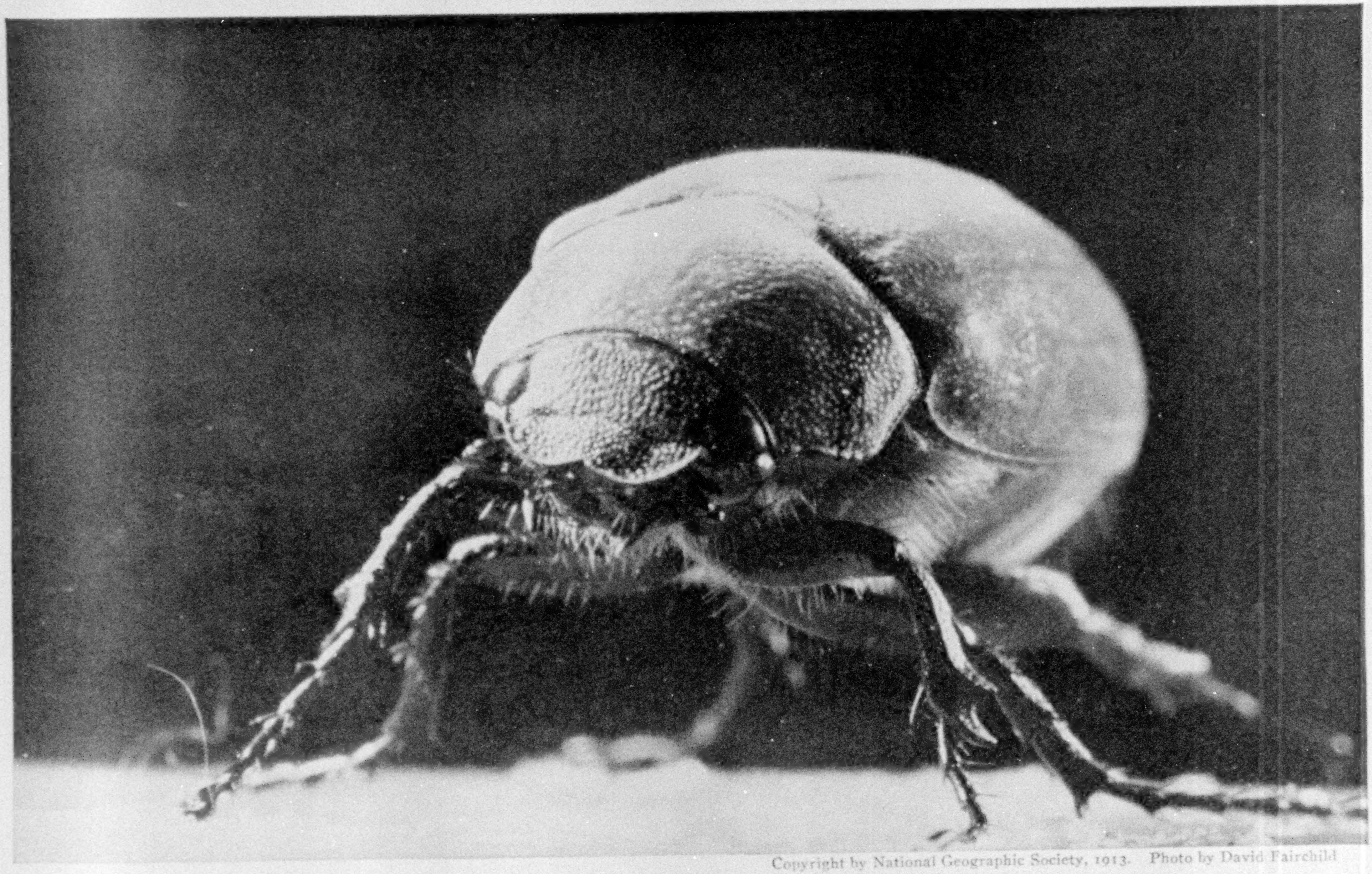
How is it possible that this fat creature, with eye-like breathing pores along its body, whose legs are worthless, and which is so helpless that it has to turn over on its back to wriggle over the ground, can change into the emerald-green June beetle which wings its way like an aërodrome across the meadow? This is the apparent miracle of metamorphosis which has well-nigh baffled the intellect of man to explain.

Though the reasons why are still unknown, modern research has shown us how this incredible change has taken place.

When this creature, which has grown a hundred times its size since it was born, has reached the age for this great change, it doubtless feels the impending transformation coming, and instinct tells it to crawl away into some protected nook or corner and pupate underneath the protection of a silken cover-lid of its own spinning.

The change begins; each organ goes to pieces, disintegrates, becomes a mass of disconnected cells, so that the body filled with these becomes, as it were, a bag of mush. This mushy fluid has been likened by entomologists to the disintegrated tissues which inflammation causes in our own bodies. If, then, you should slit it open at this stage, you would find no alimentary canal, no salivary glands, no muscles, simply a thick fluid, with here and there a thicker lump, that is attached at certain places to the inside of the sac wall. These lumps are formed of groups of active cells which were not disintegrated in the general breakdown of the muscle tissue, and these form the nuclei around which the new creature is to be built. These groups of cells grow rapidly, feeding on the fluid mass of broken-down tissue much as a young chick inside the egg feeds on the yolk, and builds up the whole complicated structure of the winged beetle, which seems to have no possible relation to the white grub out of whose body it was made.

It is as though the insect hatched twice, first from the almost microscopic



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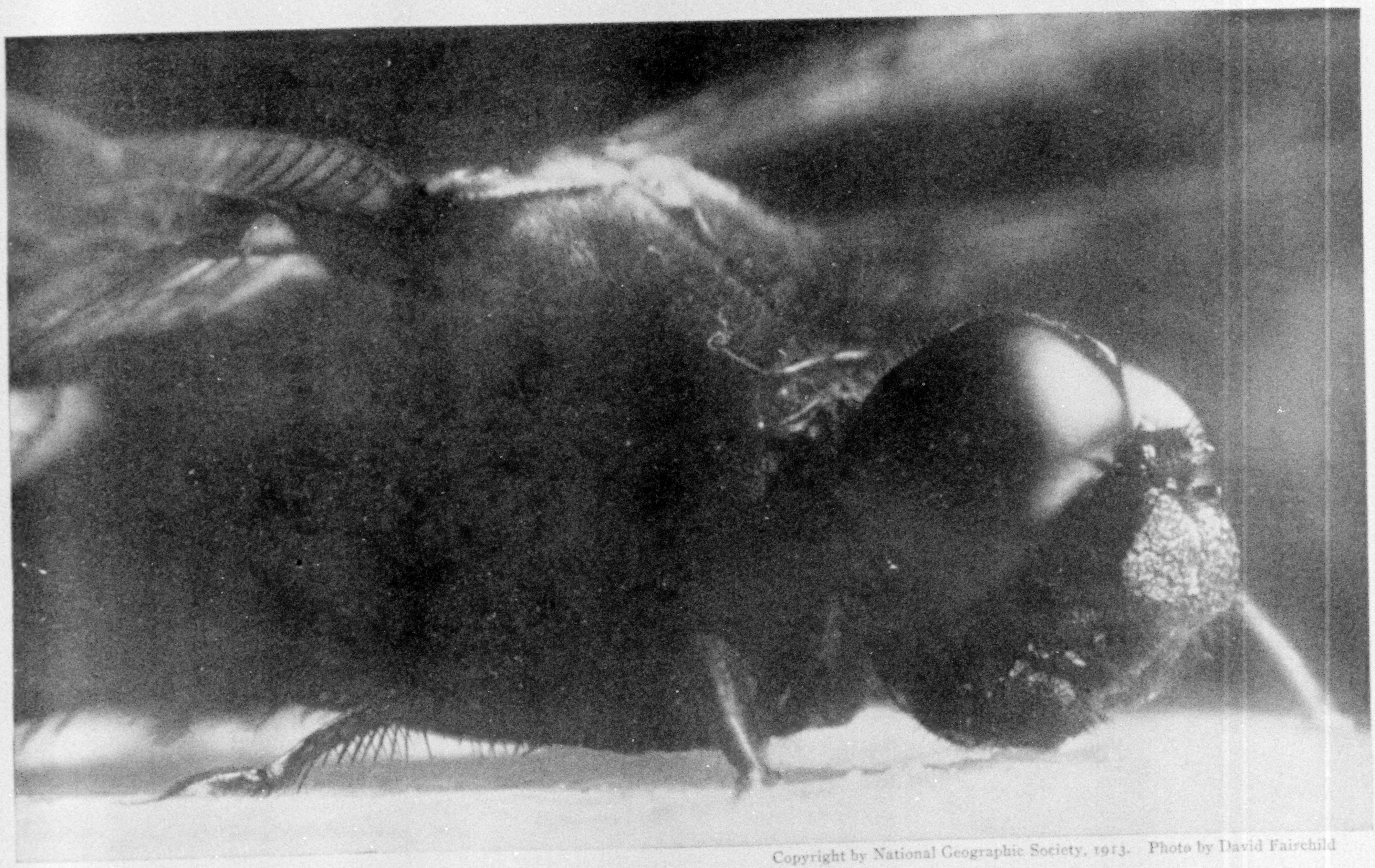
ONE OF THE JUNE-BUGS OR MAY BEETLES

The loud buzzing of this creature's wings and the sharp crack of its hard shell as it strikes the window pane at night in trying to get to the light are familiar sounds of spring. It is as strange to think that this beast was ever a white, worm-like grub as it would be to know that a hawk was developed from a mole (see page 595).



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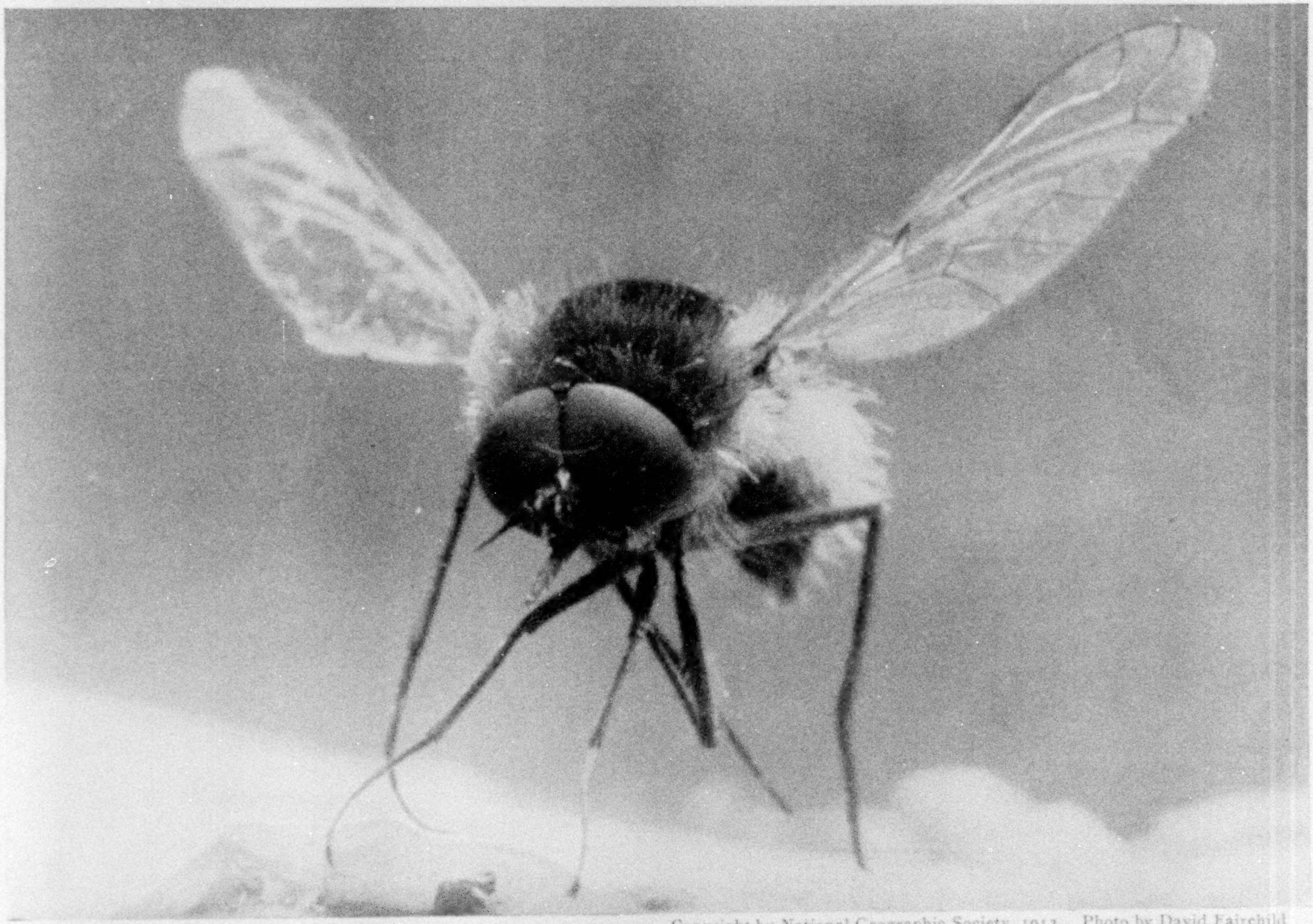
THE DRAGON-FLY

To the world of gnats and flies this dragon must be as terrible a monster as any which the mind of a Doré imagined. Two thousand facet eyes give it superb vision. Its wings, like supporting air-planes, propell it through the air with incredible speed. Its voracious jaws and powerful legs, armed with spines, all serve to make it the terror of our own plague—the mosquito (see page 597).



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ONE OF THE BEE-FLIES

As beautiful as any creature of the air can be, with velvet black body, fringed with golden hairs and diaphanous, iridescent wings and great gray eyes, which make up most of its head. In the winged state it feeds on nectar, but its larvæ lives inside some caterpillar. It is smaller than a house-fly (see page 597).

egg its mother laid and from which it emerged as a tiny little creature in the image of this grub, growing and manufacturing from the leaves it eats enough nitrogenous matter so that when it emerges again from the yolk-like substance of its cocoon it will be a full-grown beetle, for it must be remembered that once made the beetle never grows.

This wonderful process is the same which is gone through by every flying insect that has a grub or caterpillar stage.

ONE OF THE TWIG-PRUNERS (*Elaphidion atomaricum*), PAGE 589

The long-horned beetles, as they are called, are remarkable for the length of their antennæ and their eyes of many facets, which almost encircle the antennæ at their base. They have, like other beetles, two lives, so to speak, and their grub-life is spent inside some twig or branch, burrowing and living on the juices which their stomachs extract from the sawdust made by their jaws. They kill the twig they burrow in, so that the wind blows it to the ground, and they go through their transformation on the ground. The story is told of a long-horned beetle, belonging to a different species, that lived for years in its larval stage, burrowing patiently into the dry wood of a boot-last or shoe-stretcher, trying vainly to get enough nourishment out of it to make a beetle of itself.

THE PREDACEOUS GROUND BEETLE (*Chlænius æstivus*), PAGE 590

This creature almost any one will recognize as a beetle. It is built for running, and its jaws are made for fighting. You have only to catch one and watch it open and shut its jaws to realize that it would bite you if it could. But for all that it is a great friend, for it is what the entomologists call predaceous, and at night or at twilight it hunts everywhere for the larvæ of insects which attack the plants we live on. In its larval state, in which it looks for all the world like a centiped without the "ped," it burrows in the ground in search of the plant destroyers, which think to escape notice by getting under the cover of the soil. They are by nature, then, opposed to the vegetarians, the herbivores, and hunt them wherever they are likely to occur.

When you see a black or dark-brown beetle running swiftly from under some stone or log which you have just turned over and which makes faces with its jaws as though it would chew your fingers when you pick it up, you can be quite sure in eight times out of ten that it is one of these carabidæ or predaceous ground beetles, and if you let it drop from your fingers you may be saving the life of a friend, because some day it may eat the worm which, lying close to some pet flower of yours, had planned to cut it off beneath the ground.

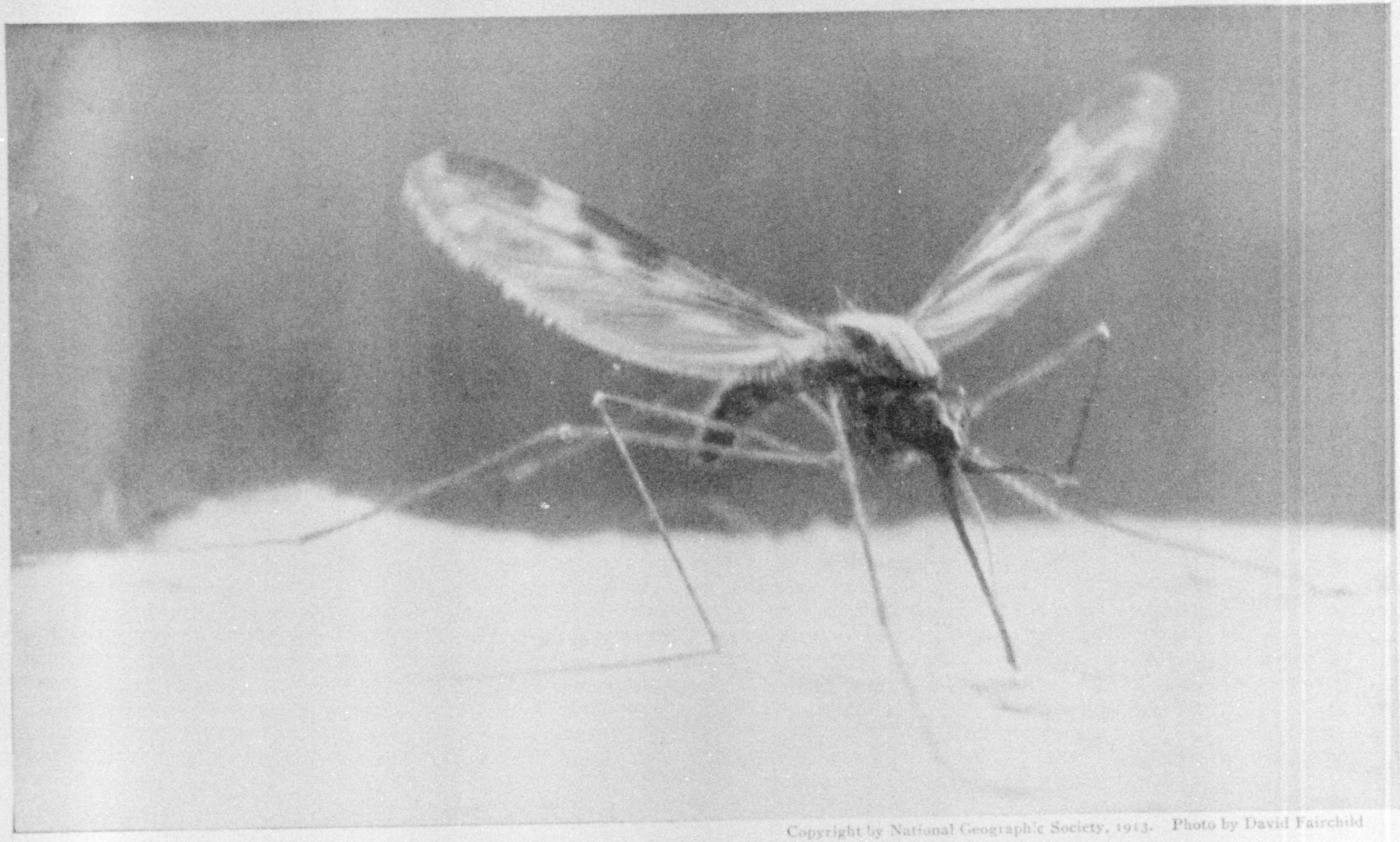
It is the hardest thing in all the world to understand how balanced is this scale of foe and friend. One year there is a wiping out of our insect friends through frost or floods or microscopic disease, and, freed thus from the check which kept their numbers down, the foes to our plants can multiply to such an extent that nothing we can do will save our crops from total failure. Next year perhaps the parasitic beetle, finding such a wealth of food to live upon, increases and holds well in check the pest which last year ate up all our plants. Each wave of insect pests could be explained, no doubt, if all the facts were known, and nowadays no one who knows what modern agriculture means will fail to reckon on the risks from losses caused by these pests.

ONE OF THE JUNE-BUGS OR MAY BEETLES (*Lachnosterna quercus*), PAGE 592

Of the wild creatures of our back yards, none is better known than this hard-shelled buzzing creature, which whirrs into the circle of light around your lamp and commits suicide, if you will let it, by flying into the flame.

It is one of the so-called June-bugs, or May beetles, which every boy and girl knows, and is not the June *beetle* of which the larva was shown previously.

Its hard, pitted skeleton covers it completely, and it is most interesting to watch it open its wing covers with great deliberation, unfold the wings which are carefully stowed away beneath them, and holding its wing covers elevated so they will not interfere, start the transparent



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ONE OF THE HARMLESS ANOPHELES MOSQUITOS

No conquest of science seems more wonderful in its simplicity and more remarkable in its importance than the discovery that the glands at the base of the mosquito's bill can become diseased and harbor a microscopic parasite, and make of this otherwise merely buzzing, annoying insect one of the most dangerous things alive (see page 597).

wings into motion and fly away with the whirr of a miniature aërodrome. Indeed, it was this resemblance which caused the members of the aërial experiment association to name one of their first aërodromes after it, and the first trophy ever given for an aërodrome flight was won by Curtiss' "June Bug."

This creature's first life is spent beneath the sod of your lawn, where it curls up around the roots of the grasses and clover and other plants which you do not want it to eat, and the first year of its subterranean existence it is the white grub, with the brown head, which everybody knows. At the end of the second summer of its life it changes to a soft brown beetle, which throughout the winter is hardening its shell preparatory to coming out in late spring as a winged creature to feed upon the leaves of trees. The beetle which is walking toward you lives upon the oak.

THE DRAGON FLY (PAGE 593)

No dragon of legend could be more bloodthirsty or terrible than this. With four wings like the supporting planes of an aërodrome, it can fly as fast as a railway train. With thousands of eyes crowded together like cells in a honeycomb, forming eye masses that cover most of its head, it can see in all directions at once. With massive jaws and teeth as sharp as needle points, it can pierce and crush the strongest shell of its prey. With its long-jointed spiny legs held out in front like a basket, it rushes through the air, catches and devours its prey and lets the carcass fall to the ground, all without slackening its terrible speed.

It is hard to realize, as you watch this swiftly moving dragon of the air, that it has spent the first stage of its life as a slowly crawling ugly water monster, lying in wait among the reeds and grasses for some unsuspecting water fly or larva to pass by.

The female, as she skims the surface of some pool, drops into the water her clumps of dragon eggs, a thousand at a time, and from these are born the ugly water-dragons which, when come of age, grow wings and, crawling to the surface, split their old skins open, unfold and dry their closely packed wings, and dart away into the sunshine to prey upon the other creatures of the air.

ONE OF THE BEE-FLIES (*Sparnopolius brevirostris*), PAGE 594

No butterfly or any other creature of the air could be more beautiful than this dream of early summer. Its black velvet body, into which the sunlight sank and disappeared; its fringe of golden hairs along the sides; its steel gray, myriad-facet eyes, of which its head was made, and its delicately formed wings, so thin that the light in passing through them was refracted into rainbow tints, made it seem to me more beautiful than almost any of those gorgeous forms of insect life which sometimes fill the clearings in Brazilian forests.

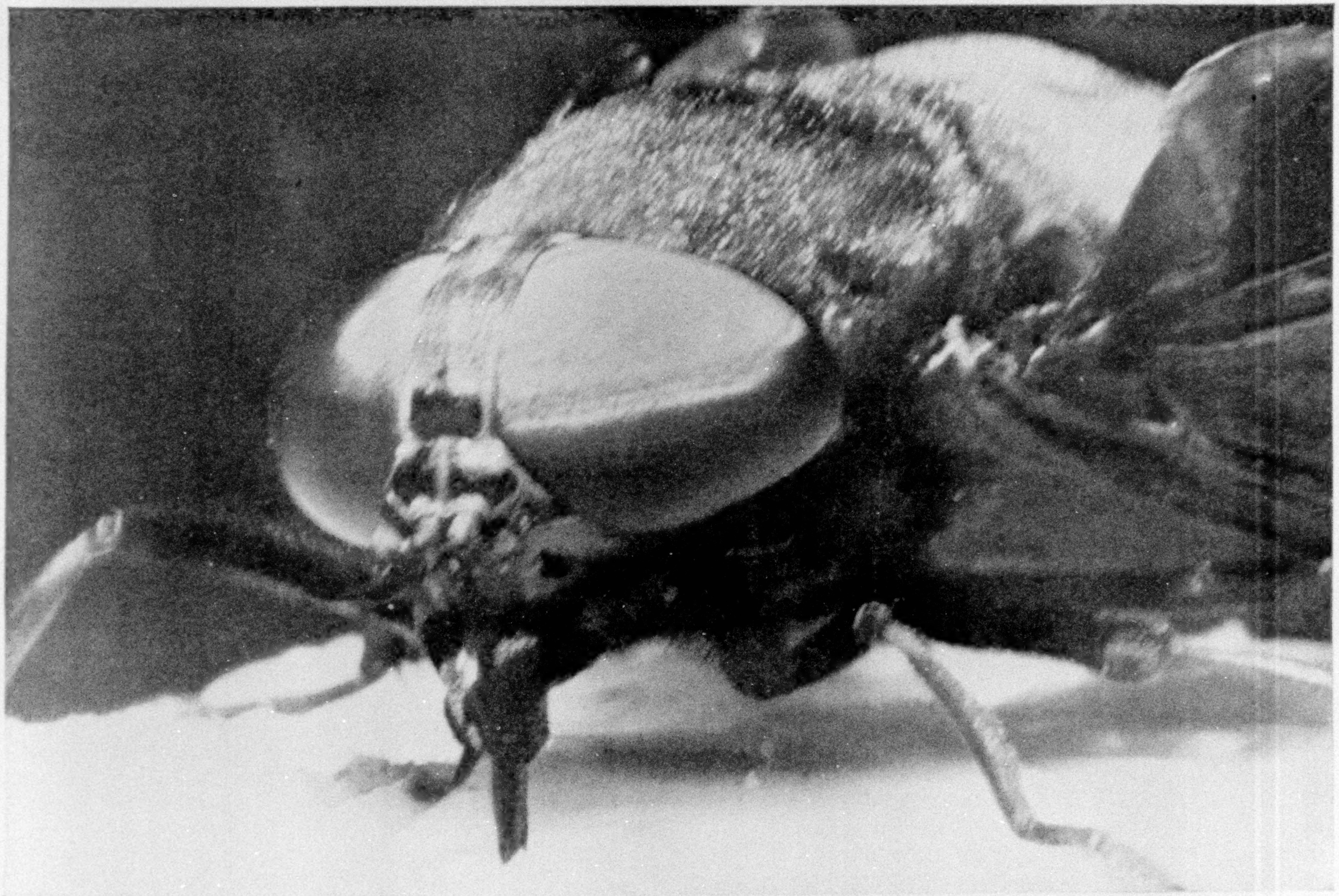
It does seem strange that such a thing as this should live its other life a parasitic grub, within the larva of some caterpillar or in the egg-case of some grasshopper; but so it seems to do. It spends its childhood as a disease and its mating days as a dainty fly among the nectar-bearing flowers.

ONE OF THE ANOPHELES MOSQUITOS (*Anopheles punctipennis*), PAGE 596

The malarial mosquito, so called, has spotted wings, but otherwise it looks quite like this harmless form from Maryland. This whole tribe of Anopheles differs from the Culex in the length of its mouth feelers, which project from the base of the proboscis and appear in the photograph almost as long as the proboscis itself, whereas in a photograph of the Culex it would appear so short as to seem merely a thickening of the base of the proboscis.

The wildest fancy of the Arabian story-teller is lacking in imagination compared with the story which the facts of modern science have woven about these tiny representatives of the fly family.

Who could imagine that just because the lady mosquitos, tiring of their usual meal of ripe bananas and plant juices, acquired the habit of sucking blood, vast regions should be devastated and beings



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THE HORSE-FLY

The thirst for the blood of warm-blooded animals is what makes the horse-fly such a nuisance, and its remarkable eyes, that can see in almost every direction at once, combined with its powerful flight, are what make it so hard to hit (see page 599)

millions of times their size should die by thousands. And this, too, not through any real fault of the tiny creatures themselves, but just because some of the persons whose blood they sucked had microscopic wiggling things living in their blood corpuscles, which crawled into the soft throat glands of the mosquito and waited there for a chance to get out into the blood channels of some other human beings.

When one pictures the grief of desolated homes, death-bed agonies, of tossing fever patients, the quarantined vessels at anchor in tropical harbors, yellow flagged with crews dead or dying, the streets of deserted houses, from which all life has gone forever through yellow fever and malaria, there is something ghastly in the picture of the winged lady mosquitos flitting airily from pale-faced patients to ruddy-cheeked happy people, unwilling carriers of death.

THE HORSE-FLY (*Tabanus atratus*), PAGE 598

The head of the horse-fly appears to be all eyes, and it is no wonder that we can so seldom take them by surprise.

Below the oblong compound eyes are the sharp mouth parts, which in the female are provided with lancets, which enable her to puncture the skin of warm-blooded animals and suck their blood. It is curious that the female should have such habits, while the males are content to lap up nectar from the flowers.

This jet black, loud-buzzing creature flew into my laboratory and made so much noise that I was forced to kill her. This photograph of her is nine times her real diameter.

She belongs to a large and important family of flies, whose females make the lives of men and animals miserable in many parts of the world by their bites, which form most annoying wounds.

THE WORKER BUMBLEBEE (*Bombus vagans*), PAGE 600

This is the real worker of the hive, an undeveloped female, a clumsy rover, her hind legs laden with a mass of pollen from the flowers she has visited.

THE POOR MALE BUMBLEBEE (*Bombus americanorum*), PAGE 601

It was late in October before I noticed, flying low here and there across the clover tops, large bumblebees, which seemed to be more covered with golden hairs than those which I had watched throughout the summer-time. At first I thought them queens, but as their number multiplied I felt I must be mistaken, and one of my insect-knowing friends explained that they were only males, and that with the approaching days of winter they were all doomed to death. Already, he pointed out, their wings were battered and frayed from flying against the autumn winds.

The importance of the males! Could there be a weaker argument against woman's suffrage than that of a noted statesman of the times, in which he said that throughout nature the duty and the right of protection rests with the male? Perhaps the drones do fight among themselves; but, as in most other fighting of the males, it is not to protect the nest or young from perishing, but merely to determine which one of them shall win the queen's attention. They are stingless.

In this world of the clover field all the work of the society is done by the queen herself or by the workers, which are infertile females, and apparently few males are wanted in the colony until late in the season, when for a brief period they are tolerated in considerable numbers as the necessary courtiers who accompany the young queens of late summer in their marriage flight. This takes place before the winter comes to kill all but a few fortunate queens, which find safe shelter in some crevice in the rocks or underneath some old decaying log.

THE PORTRAIT OF THE BALD-FACED HORNET (*Vespula maculata, Linn.*), PAGE 602

I wish I could convey to you my sensation when, in hunting for the focus on my ground glass, this creature burst upon my sight. It was as though, exploring in some strange land, I suddenly stood face to face with a beast about which no school book had ever taught me anything.

It peered at me out of the gloom of

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THE WORKER BUMBLEBEE

Everybody has a friendly feeling for the bumblebee, and this portrait seems in keeping with that spirit. The workers are the undeveloped females, and, with the devotion of conscientious trained nurses, they buzz about from flower to flower gathering pollen in their pollen baskets, that are on their hind legs, for the young which hatch from their queen sister's eggs (see page 599).

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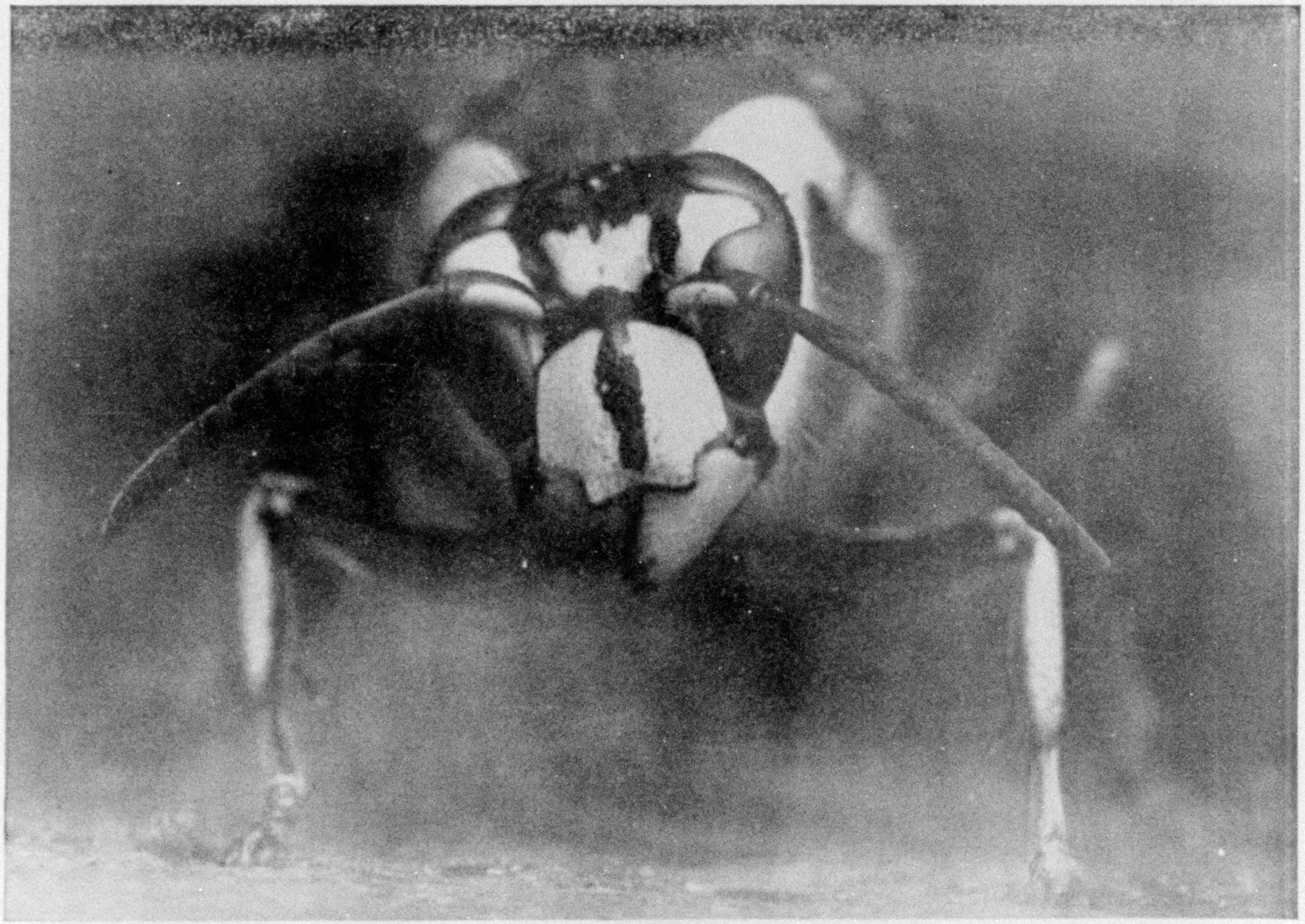
THE POOR MALE BUMBLEBEE

This is one of the courtiers of the hive. Its larger size and hairier body distinguish it from the workers. It leads a very brief existence; just long enough to court some young queen and die when winter approaches. It has no sting, and altogether leads a luxurious life, supported in this luxury by the hard-working, childless females of the colony (see page 599).



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PORTRAIT OF THE BALD-FACED HORNET

If you have ever molested the paper-like nest of this creature and been near enough to look her in the face, you have been braver than most men, for to be stung by her is a more painful experience than any one cares to have. What a terror she must be to the buzzing house-fly! (see page 599).

imperfect focus, and it took me some time to realize that I was looking into the eyes of a bald-faced hornet, and that, instead of being an enemy, she is of all the fly-destroyers which frequent the house perhaps the most efficient, pouncing upon the flies with murderous voracity, tearing off their heads and legs and wings and macerating their bodies to a pulp to feed the hungry grub-like baby hornets which are hatching out in the paper nest over the front door.

Does this picture represent, I wonder, one of the nightmare visions which haunt the dreams of baby flies?

There is no wild creature in the northern United States that a man will run away from so fast as from a bald-faced hornet.

At the tip of her flexible armor-plated abdomen is the poison-fed stiletto with which she paralyzes her prey or drives off enemies from the nest.

Her six powerful legs are spined to help her, no doubt, in climbing over the smooth surfaces of flowers and twigs. She has two kinds of eyes—three lens-shaped ones on top of her head and two marvelous compound ones composed of hundreds of little lenses, which take up half the head. Just what she uses each kind for is still unknown.

From her forehead hang ringed antennæ, which doubtless are the organs with which she scents the presence of her prey, and they may also help her find her way about.

Her massive jaws lie below her eyes and look like shears with jagged edges; they are meant for crushing, not for grinding, and with these she tears to pieces bits of wood and cements the particles together with the sticky secretion of her salivary glands, making thus the combs and shelter of her wood-pulp paper nest.

She is an undeveloped female, but with the professional care of a baby's nurse she tends her sister hornets in the nest. On the wing, from daylight to dark, she scours the country for the flies and other insects with which to feed the young.

Her life is ended by the autumn, for she feels the cold as all our insects do, and it is left to a few of the young queens to carry on the species.

There is something fascinating in the picture of the young queen hornet, after mating is over and all her relatives are dead, crawling away beneath some log to pass there the long cold winter, and then alone, when spring has come, emerging from her sleep, the only survivor of her race, to build, unaided even by her mate, the beginning of a nest just large enough to hold her first-laid eggs. From these hatch out the grubs, which later, after days of feeding, emerge as workers, undeveloped females, and help build up around her a colony of hundreds of busy hornets.

THE YELLOW JACKET (*Vespa carolina*), PAGE 604

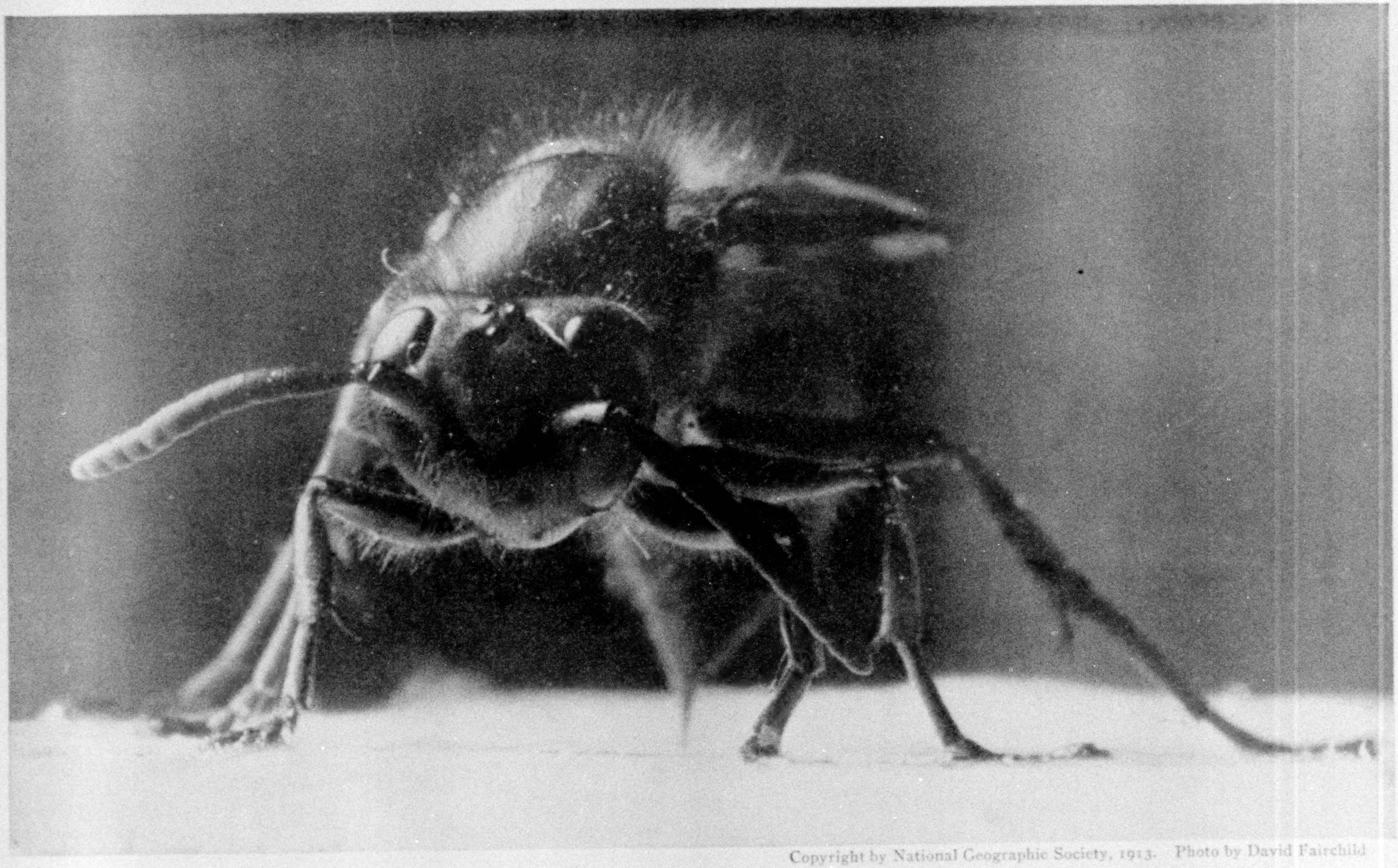
All the readers of the NATIONAL GEOGRAPHIC MAGAZINE have probably had a more intimate acquaintance with the creature shown on page 604 than I can possibly give by any picture. It is the ordinary yellow jacket of our fields.

THE SOLITARY LEAF-CUTTING BEE (*Megachile brevis*), PAGES 606 AND 607

The sting or "stinger" of a bee is indeed a most wonderful piece of mechanism. At the base, inside the body of the bee, lie bars or levers, operated by muscles, which push the darts out and draw them in. The poison sac lies just behind this mechanism and pours the poison into a set of cup-like valves, from which it escapes into the wound along longitudinal groves in the sting like grease along the piston of an engine.

The sting itself is not, then, hollow, like the spider's poison fang.

Unlike the social honey-bees, this bee leads a solitary life. With her strong, saw-like jaws the female makes her burrow in soft wood and lines it with bits of leaf which she has cut in circles from the roses and other plants; then, making a ball from the pollen and nectar which she has gathered, she puts it at the bottom of the burrow, lays an egg upon it, and with a wad of leaves securely shuts it in; over this again lays down another food ball, with its corresponding egg, and so on until the burrow is full.



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THE YELLOW JACKET

Who has not wished that these striped brown and yellow creatures would build their nests where people could see them and be warned to stay away? They hunt in flocks, and is it any wonder that with the sides of their heads all eyes and with three other eyes in the top of the head they should quickly find any one who treads upon their underground nest? (see page 603).

A COMMON RED ANT (*Formica sp.*), PAGE 608

There are probably five times as many species of ants in the world as there are species of birds in the whole of North America. There must be hundreds of times as many individuals. "They are undoubtedly the highest, structurally and mechanically, of all insects and at the same time the most efficient." Their social organization has been the admiration of human beings from the earliest times, because the interest of the individual is merged so completely into that of the colony; but, as Wheeler remarks, their organization must strike the individualist with horror. It is an organization of females, too. The workers are females, the soldiers are females, the nurses are females, and there is one queen mother for them all, who lays all the eggs of the colony. Where are the males, those representatives of society, those voters of our human colonies? They do not exist as such, for the males of ant colonies are but mates for the young queens. Together with them they leave the nest on their marriage day and together make the marriage flight, but as soon as this is over they die and the colony gets on easily without them. To man, who is the most rapidly evolving organism on the earth today, it is a strange thought that the most highly developed insect which the world has produced, and which has not changed materially since the Tertiary epoch, has relegated the males to the short-lived function of reproduction, leaving him no work to perform and getting rid of him as quickly as possible. Why did the ants, with their marvelous instincts, fail to conquer the world? Why have they stood still for thousands of years after they had perfected their social organization? Did they go as far as evolution could go when it leaves the male out of account? It is perhaps a comfort to think that, after all, they have failed and the man-guided organization of human beings has surpassed them in its development.

FORE PART OF A BROWN BUTTERFLY (*Argynnis cybele*), PAGE 610

It is hard to realize that this is the portrait of the head and fore part of a beautiful brown butterfly.

Its head is almost all taken up with the gigantic eyes, which are composed of thousands of tiny facets. The long, trunk-like mouth with which it sucks the nectar from the flowers is coiled up like a watch spring. Like shingles on a roof, the scales are fastened in tiers over the broad surface of the wings stretched over the stiff ribs or frame-work.

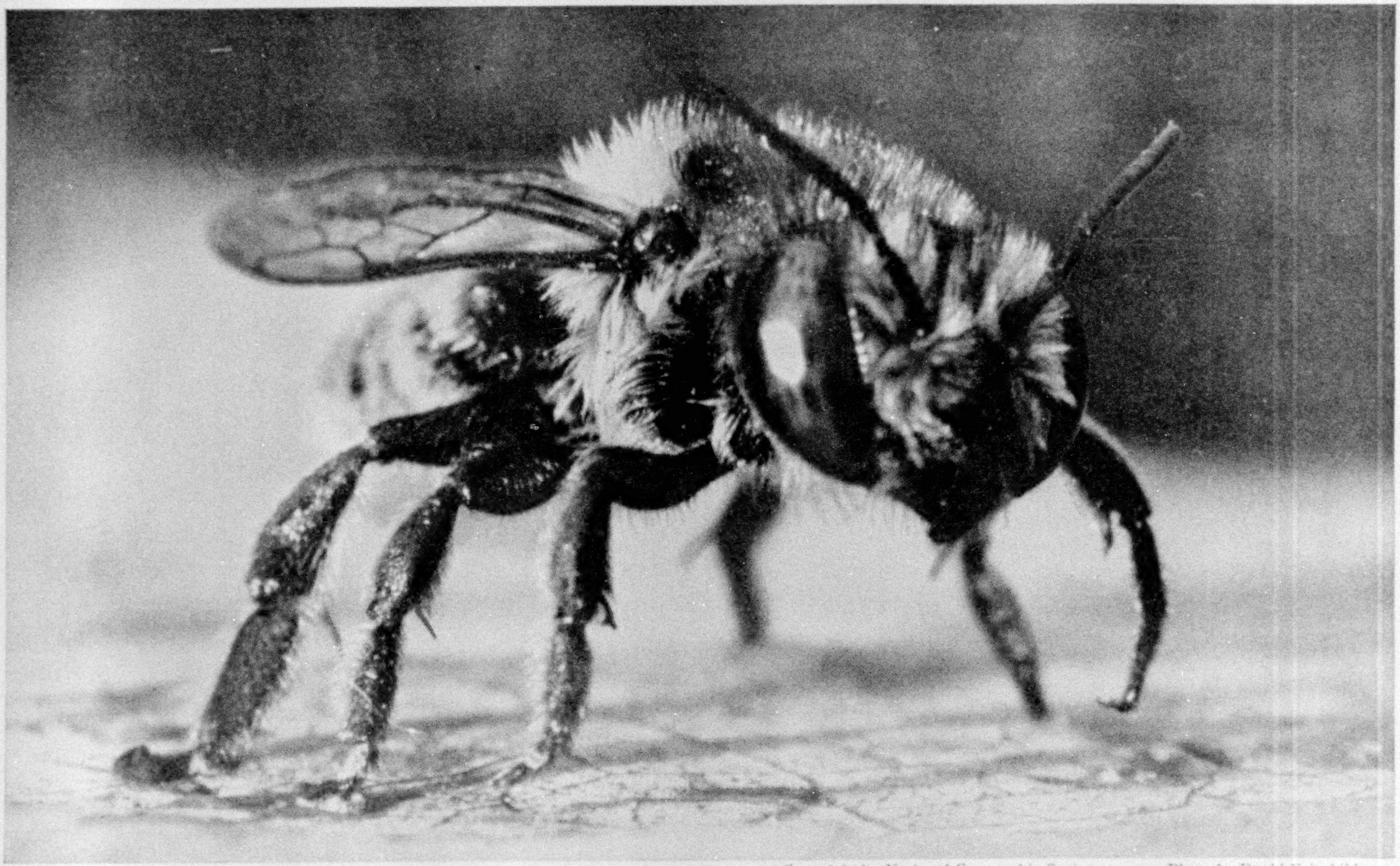
The white spots are made by hundreds of white scales and the brown blotches by brown scales, and what these scales are for nobody seems to know. Perhaps they help to grip the wind, for they have running lengthwise of them deep and parallel corrugations so small and fine that were a single scale as large as a lady's opened fan these corrugations would represent its sticks.

The caterpillar from which this splendid creature came is black, with branching spines and feeds at night on violets and other plants.

The graceful beauty of the butterfly, its seemingly happy existence, its life among the flowers, where it sips the nectar that the flowers provide, are all a part of common knowledge.

The real life of the butterfly, however, is not so pleasant as we think. Have you ever found a butterfly hanging beneath a leaf on a cold summer morning drenched with dew and stiff with cold? Have you ever seen one trying to cross a field in a rain-storm and observed it vainly attempting to navigate the conflicting air currents? Where do they roost at night and on rainy days? Where do they come from and what becomes of them? These are matters which it has often taken men years to find out, and even now there are many thousands of species of butterflies which are known only by a preserved specimen caught in its flight by the net of some collector.

It is easy to tell any butterfly from a moth by the clubs which it has on its antennæ, and although the entomologists have decided that this classification is unscientific, it is quite as uneducated to call one of these beautiful creatures with club-shaped antennæ a moth as it is to call a mouse a rat or a lizard a snake.



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A SOLITARY LEAF-CUTTING BEE (FRONT VIEW)

When the rose leaves in the garden have round holes through them, in nine cases out of ten they have been cut by this solitary bee. She uses the round pieces to line her burrow with, gumming them together with the sticky secretion of her mouth. Her young never see her, for they hatch out after she is gone and feed on the balls of pollen and nectar she has gathered for them (see page 603).

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A SOLITARY LEAF-CUTTING BEE (SIDE VIEW)

Are there any other flying creatures which have such a weapon of defense as this one has? A poisoned stiletto as long as her forearm, which she can thrust in and out with incredible rapidity, and which, as every one knows, can inflict a painful wound on creatures millions of times her size (see page 603).

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A COMMON RED ANT

This individual belongs to one of the oldest and most remarkable social organizations of female creatures in the world. Its ancestors, embedded in amber thousands of centuries ago, were almost identical in structure, and its instincts seem as rigid and unchangeable as its structure. The interest of each member is so completely merged in the welfare of the colony as to strike the individualist with horror (see page 605).

Of the butterflies, so called, which flit across our lawns and flutter from the grass as we brush through it, nine out of ten are moths with feathery or pointed antennæ.

It is said of certain species of yellow butterflies that the males give off a pleasing, aromatic odor which is exhaled from the front wings through hundreds of minute, slender scales—scales quite different from those with which the wings and body are covered. This scent, which is so strong that it can be detected by even our blunted olfactory organs if we rub the wings between thumb and forefinger, is supposed to attract the females in some way that is little understood. As among these particular butterflies the male seeks out its mate, it is difficult to understand why it should be the male which has the perfume, since it does not serve to tell the female where her mate is to be found. The inference is that in some way the perfume charms the female.

In some species it is the females which give off an odor, and in either case the distances over which these odors extend and are detected by the males or females respectively are analogous to the inconceivable reach of wireless telegraphy. And who knows but the mechanism of these creatures is set to respond to the swifty traveling ions which make wireless telegraphy possible.

The Doctor Jaeckel and Mr. Hyde is so complete between the butterfly which flits over the cabbage patch and the velvety green worm that eats holes in the leaves of the cabbages that it is no wonder that for centuries no connection between the two careers of these creatures, seemingly so far apart, was suspected. In general it is true that no moth or butterfly is injurious to plants except in its larval stage, and herein has laid the clever deception which has doubtless protected these gay mating creatures of the air from the systematic attacks of man until quite recent times.

LARVA OF THE SWALLOW-TAIL BUTTERFLY OF THE SPICE-BUSH (*Papilio troilus*), PAGE 611

Is this, I wonder, an insect make-belive, a caterpillar mask, as it were, to frighten away enemies? The black and white eye spots are not real eyes, but to a bird they doubtless seem so. Its real eyes are inconspicuous points at each side of the head, too small to appear in the photograph.

Few of us stop to think as the beautiful swallow-tailed butterfly, gorgeous in its black and yellow painted wings, flits by us that it is made of sassafras and spice-bush leaves gathered together and ground up. This monster is a leaf-eating creature, its purpose being the accumulation of food material out of which is made inside of it the gorgeous swallow-tail butterfly. It feeds on sassafras and spice-bush leaves, and when the time arrives makes a nest for itself by fastening the edges of a leaf together. In this nest it passes the winter. When spring comes it breaks open the gray shell of the chrysalis, unfolds a pair of black and gold wings with long tails to them, and flies away in the sunshine in search of flowers and a mate. It is then no more like this monster than an eagle is like a hippopotamus, yet after it has flown about, sucking nectar through its long beak, it mates and lays a mass of eggs, out of which hatch again these strange, weird beings.

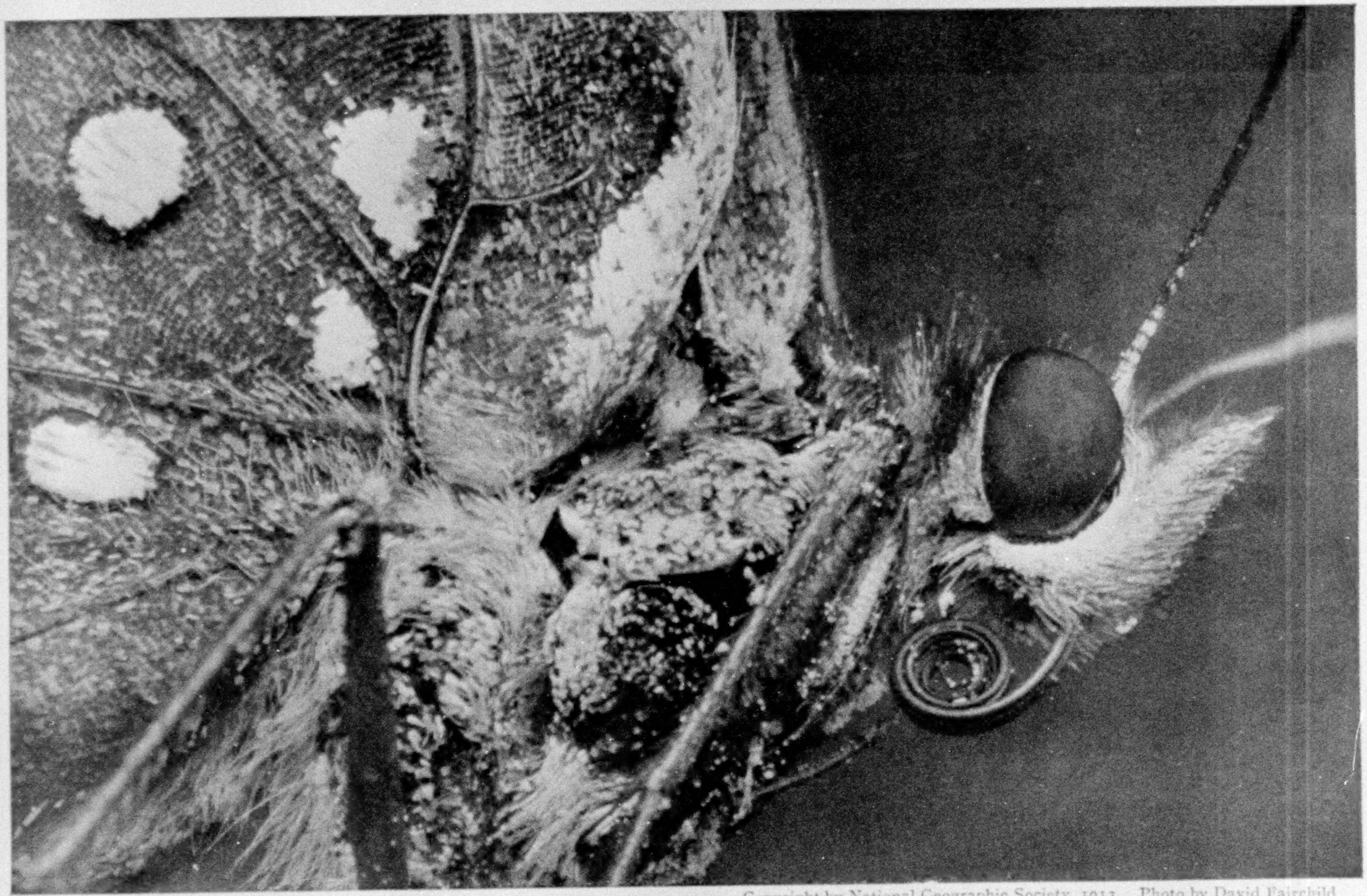
A BUG THAT IS ALWAYS WALKING AROUND (*Brochymena arborea, Say*), PAGE 612

This is, as my friend Dr. Schwartz says, just one of those bugs that is always walking around on plants, and nobody seems to know just what it is doing.

A QUEER UNWORLDLY MONSTER (*Corynocoris distinctud*), PAGE 613

Could anything be more antediluvian and unworldly than this old broken-down creature, with six crooked legs, a pair of popping-out eyes, two shining ocelli which look straight up into the air, and a long stout beak that is partly hidden behind one of the fore legs?

A discussion of how such a fright of a thing came into existence leads one into the realms of evolutionary science, and there we should perhaps find it suggested that it is so ugly and looks so much like the bark of the trees on which it roosts that birds have passed its ancient forefather by, and through the



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FOREPART OF A BROWN BUTTERFLY

Nature seems to make her short-lived children just as beautiful, perhaps even more so, than the long-lived ones. These gorgeously colored wings which attract our attention by their great patches of white and red and are made beautiful by millions of scales, each of which is in itself a thing of exquisite beauty, are made for the service of a few sunny days only (see page 605).

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LARVA OF A SWALLOW-TAIL BUTTERFLY

It would be interesting to discover whether to a bird or other enemy the black and white eye-spots, which make of this caterpillar a fit subject for a nightmare, appear as monster eyes and frighten it away. The true eyes are small, invisible ones at either side of its light-gray head (see page 609).

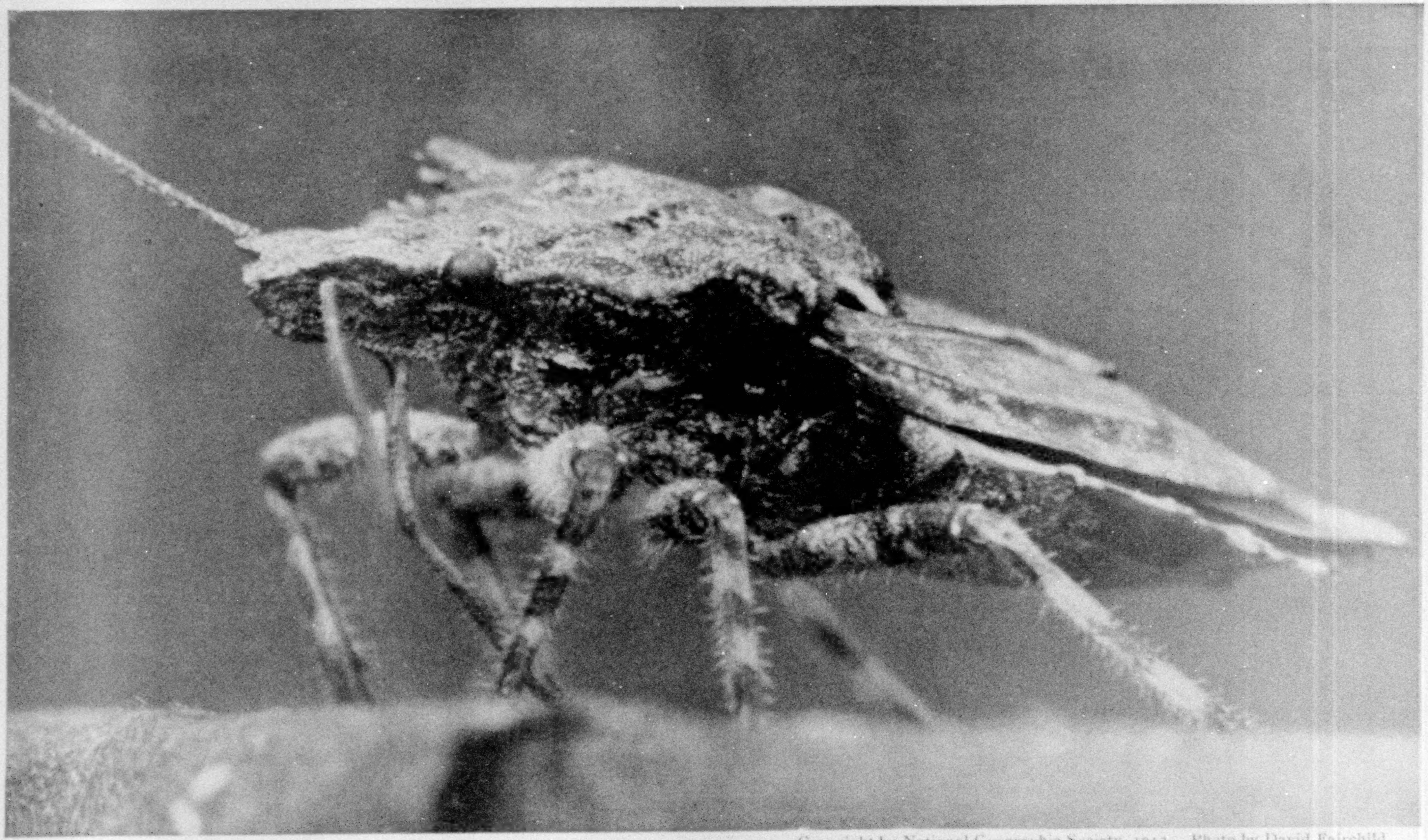
weird workings of that little-understood law of heredity this thorny, spotted creature has waddled along year after year, keeping up in the race for hundreds, perhaps thousands, of centuries. I cannot help exhibiting a little of the showman's pride in it; for, as Barnum would say, this is positively the first real appearance of this century-hidden, hoary monster before the every-day public.

According to the books, this species belongs to a strange family, in which are even more remarkable-looking creatures. They are all, however, characterized by having the femora of their back legs covered with knobs or spines. One of the species is so spiny all over its back that the male makes use of it to carry around the freshly laid eggs of the female.

THE SQUASH-BUG (*Anasa tristis*), PAGE 614

The smell of the squash-bug is known to every country boy. The odor is emitted through openings in the abdomen from special stink glands, which vary with each species.

The tough external skeleton explains perhaps why no spray is strong enough to kill the fully grown insects without also injuring the young squash and pumpkin vines, and why the best method of prevention consists in screening the young plants with a wire screen until they have grown large enough to be immune from attack. If you can find the young insects which are not yet encased in such a hardened shell, spraying with a 10 per cent kerosene emulsion will stop



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A BUG THAT IS ALWAYS WALKING AROUND

The fields are so full of strange-looking creatures that the habits of this one, which looks like a six-legged oyster, are not well known even to entomologists (see page 609)

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A QUEER, UNWORLDLY MONSTER

Merely one of the thousands of weird creatures which inhabit the jungle of our back yards, and which, were they as large as this photograph, would be as familiar to us as are the squirrels and rabbits which we find there; but which, because they are only a half inch long, are known by name to a few men only (see page 609).

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THE SQUASH-BUG

It would be hard to get at the true character of the squash-bug, but looked at from the side and on his own level, he appears to be a rather clumsy creature, with a prodigiously thick hide, an eye which pops out of his head, two jointed antennæ, and a beak which is tucked under his chin. If he were as large as the photograph, he would be an ugly customer in the garden; in fact, he is that anyway, though he is not an inch in length (see page 611).

up their breathing pores and asphyxiate them.

The one in the picture is an old specimen, preparing to go into winter quarters under the leaves and wait for the tender squash and pumpkin vines to appear above the ground.

It is surprising how quickly they find these juicy shoots, which they pierce with their sucking beaks and upon which they lay the eggs which in a few days hatch out into a brood of small but voracious squash-bugs.

It is difficult to realize that the species to which this creature belongs is only one of 5,000 distinct species known in North America, or to fully comprehend the force of a remark made by David Sharp, the English naturalist, that "if anything were to exterminate the enemies of the true bugs, we ourselves should probably be starved in the course of a few months."

In other words, it represents an order of sucking insects of many strange shapes which, although directly connected with the welfare of the human race, has been, until recently, the most neglected of all the great orders of insects.

To this order belong the chinch-bugs, the cause of an estimated loss to grain-growers of 20 million dollars a year; the great Phylloxera, which destroyed the vines on 3 million acres of French vineyards, and the San José scale, which has spread during the past ten years through every State and Territory in the United States and become a menace to the fruit-growing industry.

AN ORB-WEAVING SPIDER (PAGE 616)

This creature has eight four-jointed legs of varying lengths, covered with large bristles which are hollow and sensitive. Hidden behind these legs is the head, with eight eyes, strong jaws, poison fangs, and a pair of palpi which look like extremely short legs and seem to serve as hands. The hairy body is filled with thousands of eggs and contains also a marvelous reservoir of liquid rope opening into spinnerets on the under side of the body.

Before you are up on a summer's morning, this wonderful creature will have manufactured what would be equivalent to two miles of elastic and sticky rope if she were as large as a six-foot man. With the skill of an experienced fish-net maker, she will in a few hours construct a net as large as a cart-wheel, with tough, dry, radiating spokes, between which are looped sticky, elastic threads, which no little flying creature can strike against without running the risk of sticking fast.

A VAGABOND SPIDER (*Pardosa milvina*), PAGE 617

This is a vagabond of the spider world, building no nest or web, content to use her marvelous silk in the construction only of a sac in which to lay her eggs. This sac she carries about with her until the eggs have hatched and the spiderlings are strong enough to take care of themselves, and then she rips open the sac along a distinct seam on the edge and turns her babies loose to shift for themselves.

These voracious little cannibals have, however, already learned to forage, as the struggle for existence in many species of spiders begins in the egg sac, and it is only the strongest who emerge. In other words, they eat each other up.

They do not grow to be more than half an inch in length, but they are among the most active of all spiders, and in the United States alone there are nearly a score of species of these little soldiers of fortune living nowhere and roaming the damp fields in search of prey.

A JUMPING SPIDER (*Phidippus audax*), PAGE 618

We are so accustomed to beasts with two eyes that it is hard to realize that all around us, though hard to see, are little monsters with many eyes of various sizes.

This one has eight eyes, four of which are invisible from the front. The eyes are diurnal, enabling the creature to hunt only by day. Its eight stout legs fit it for jumping forward or sideways with great ease. In comparison with its size, its jumping powers are incredible. If it were the size of a tiger, it would be a

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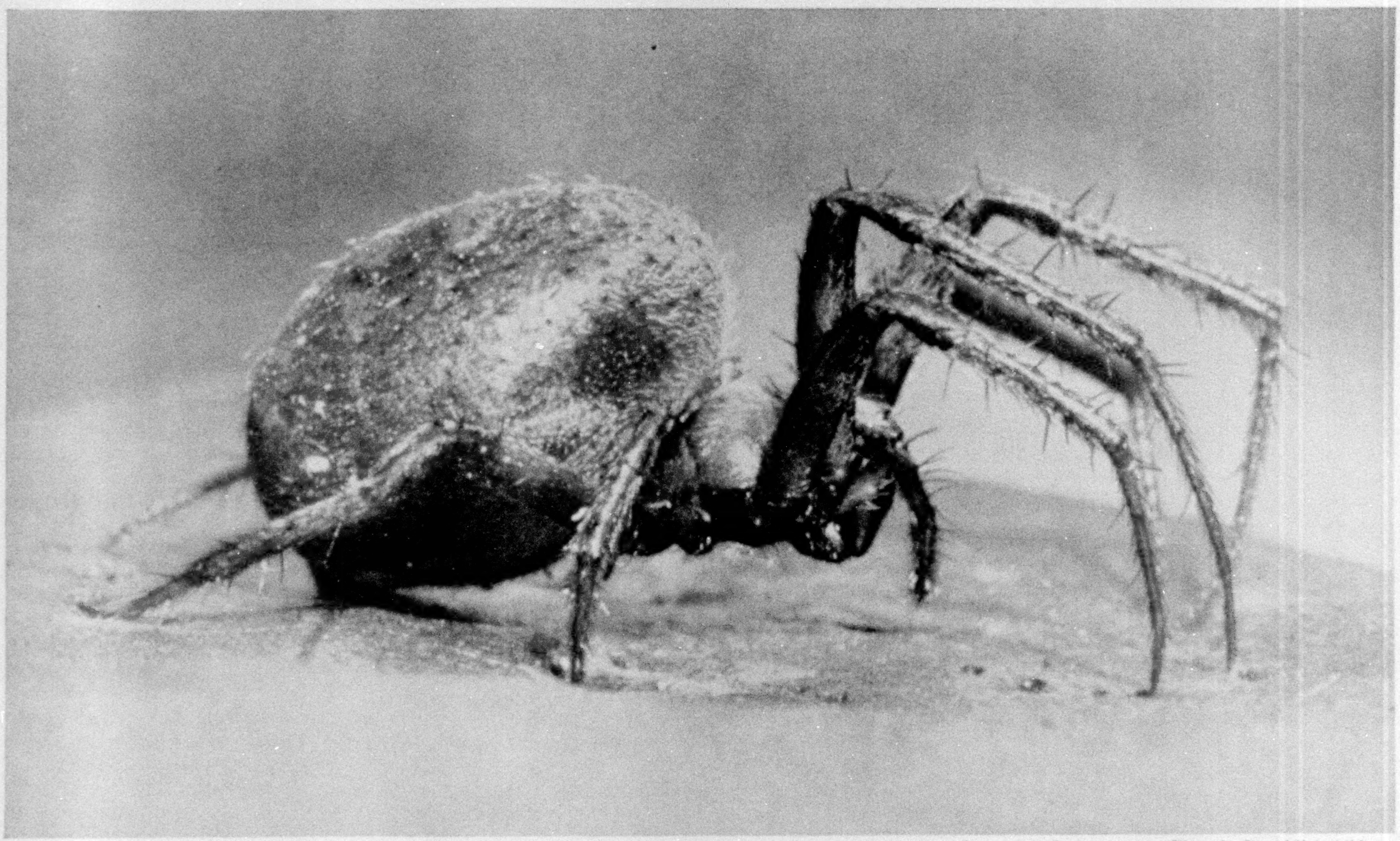

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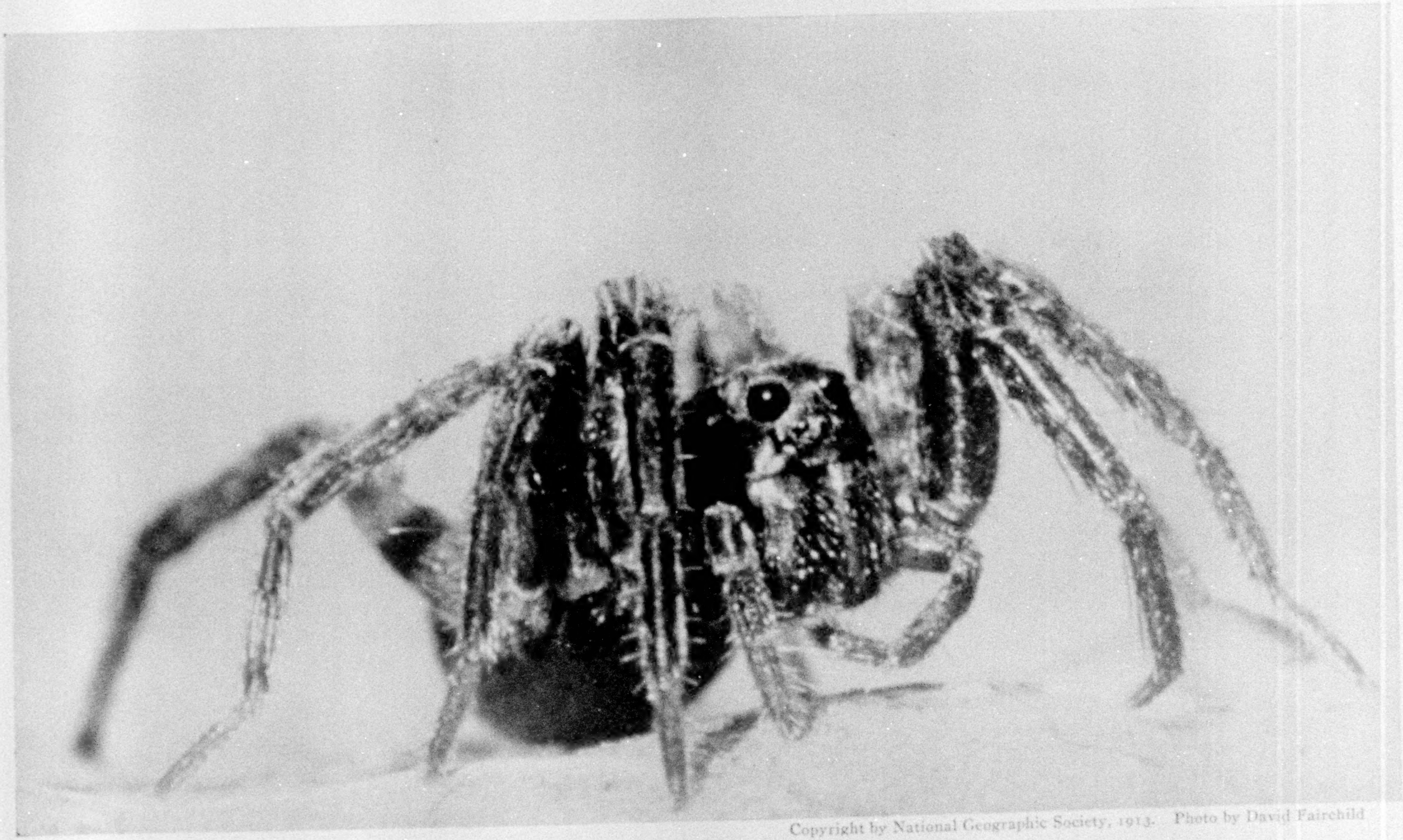
AN ORB-WEAVING SPIDER

It is only when one rises early and wanders through the fields and sees the dew-covered webs of the orb-weavers that he realizes how all about are wonderful creatures, with long, muscular legs and hairy bodies, which hang all their lives through to nets made of a secretion of their own bodies, waiting for their food come to them (see page 615).



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A VAGABOND SPIDER

It would be hard to imagine a creature more fitted to live off the game it catches than this wandering spider hunter. To see it pounce upon its prey and kill it with one stroke of the fangs through its head is to get some idea that the struggle for existence is not merely a phrase to be found in the works of the great Darwin (see page 615).

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A JUMPING SPIDER

This spider builds no web, but sitting in ambush, on some leaf or twig, it waits until some flying creature passes near, when it springs and catches it in midair, spinning out behind it a drag-line, back along which it climbs with its prey in its jaws. What must the sensations of a fly be when he looks into the diabolical countenance of this monster, no matter if he is only a quarter of an inch long! (see page 615).

beast of prey which could clear a quarter of a mile at a bound.

It can sit on a branch and throw out an elastic dragline behind strong enough to bear its weight, and by this means it is able to jump at and catch its prey on the fly, regaining its position by climbing up the dragline. Add to this that it possesses a pair of powerful hollow fangs, into which poison sacs empty, and a voraciousness which often leads it into cannibalism, and you have a fair picture of this jumping spider, which is one of a thousand species of little creatures found everywhere except in the polar regions. They range in size from a third to a half an inch long and live under stones and sticks, spending the winter in a silken bag of their own manufacture, but never spinning a web. The males of some species have been observed to dance before the females, holding up their hairy legs above their heads to show off their ornamentation.

THE WOLF-SPIDER (*Lycosa carolinensis*), PAGE 620

This is not the photograph of a polar bear, but that of the wolf-spider, with a battery of eight eyes on the top of its head and poison fangs hanging below.

Behind and above the fangs and hidden in their shadow is the creature's mouth—toothless and made for sucking only. With his fangs this wolf-spider kills and crushes his victim; then he sucks the body dry and throws away the carcass.

Seen here and there above the body hair are black spines, hollow inside and connected with the nerves of touch. Of his eyes, the two in the center in front are supposed to be for use by day, while all the others are nocturnal, enabling him to stalk his prey at dusk. It is the wolf-spider that often appears at night within the circle of lamplight searching for nocturnal insects.

The nocturnal eyes are remarkable organs, with reflecting structures so placed behind the retina that the light entering the eye traverses the retina twice, and it is supposed that this reflecting structure increases the effect of any faint light, enabling the creature to "see in the dark."

This is a hunting spider, chasing its prey through the grass or lurking under stones, especially in damp places.

It does not spin a web, but lives in a silk-lined hole 6 or 8 inches deep, which it digs in the ground, and around the entrance to which, out of sticks and grass, it builds a turret or watch-tower, from which it can see its prey more readily than from the ground. These spider holes are common in the meadows of Maryland.

In form and color the wolf-spider resembles the famous tarantula of southern Europe, the bite of which was supposed to cause the tarantella, or dancing madness; but it is as harmless as a butterfly, and indeed Dr. Comstock, who is the authority on spiders, believes that no spiders in the Northern States are poisonous to man.

SKELETON OF A WOLF-SPIDER (*Lycosa punctulata*), PAGE 622

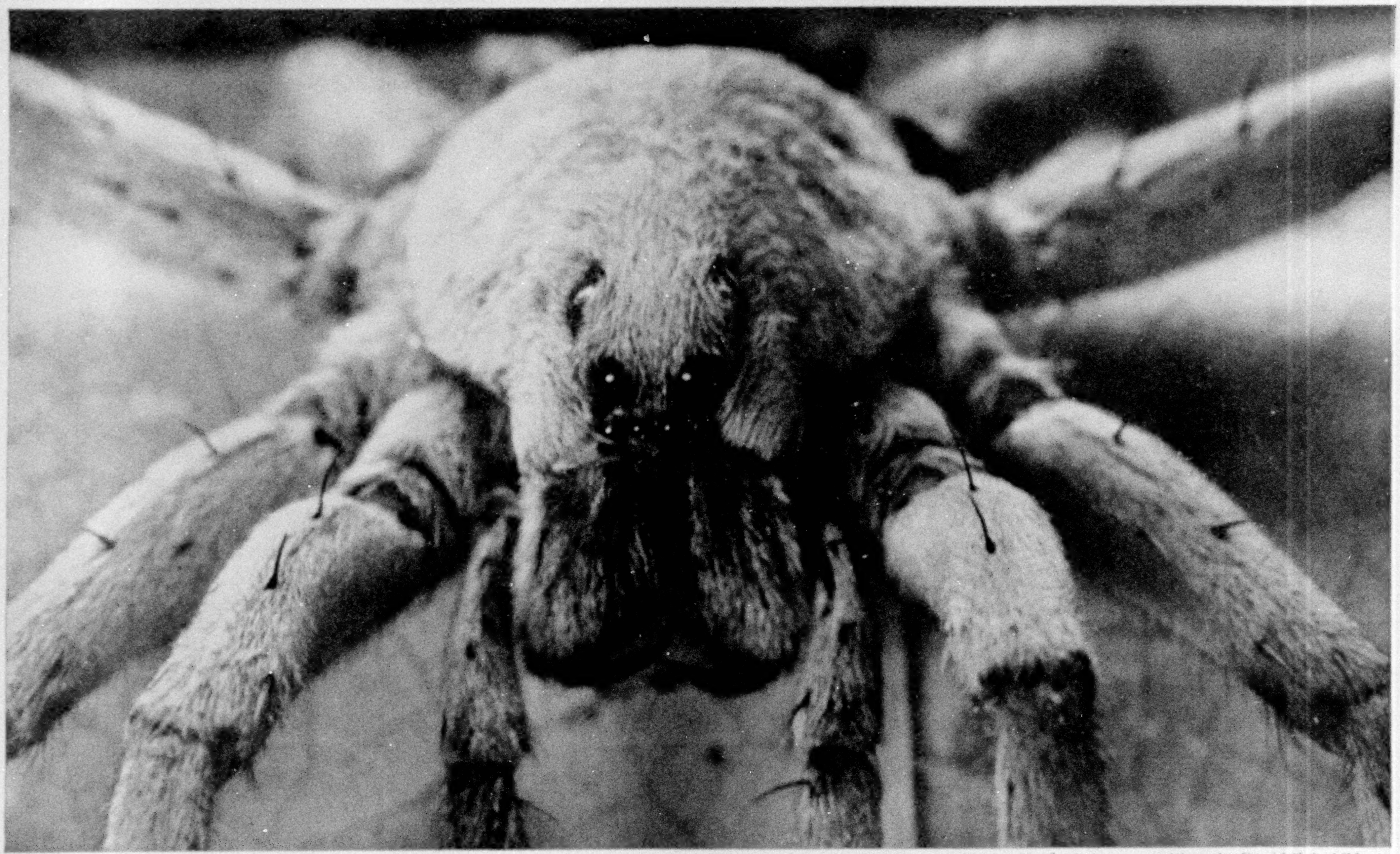
This photograph is the outer skeleton or shell of a small wolf-spider which I found clinging to the focusing cloth of my camera after it had been lying on the grass.

With us the bony skeleton is internal and grows as we grow. With spiders the skeleton is a tough, bony structure, which cannot change; so that the young, rapidly growing spider soon finds his shell too tight for him, and, like a crab, he bursts his shell and pulls his soft body from each leg and complicated cavity.

This process seems marvelous, but is really comparatively simple when we realize that before the old shell is cast off it is loosened from the new skin by the moulting fluid which is excreted from glands opening through this new skin.

After the old skin is loosened it splits along the sides of the body and in front of the eyes, the slit being just above the legs and jaws, and that portion of the old skeleton which had covered the back is lifted off like a lid. The new skin, at first elastic enough to accommodate the increased size of the body, soon becomes hardened like the old, and must in its turn be shed.

Imagine, if you can, the surprise of a wolf-spider who in running through the



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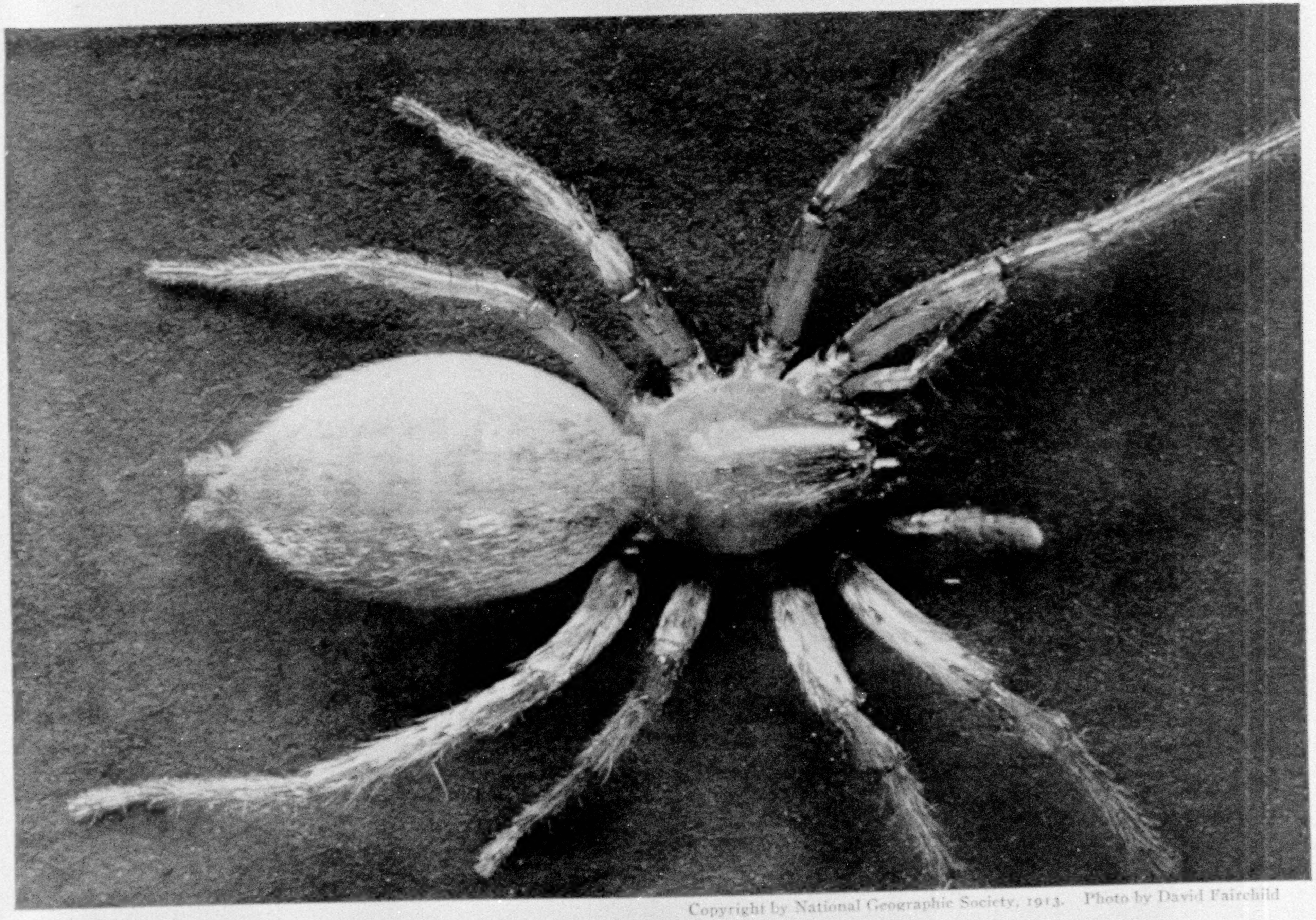
THE WOLF-SPIDER

Some such an impression as this, I imagine, must be made on the retina of a bee or a wasp when, in wandering through the grass, it suddenly finds itself face to face with a wolf-spider sitting on the turret which forms the entrance to its web-lined hole in the ground. This spider spins no orb, but stalks its prey, or waits for its approach at the entrance to its nest (see page 619).



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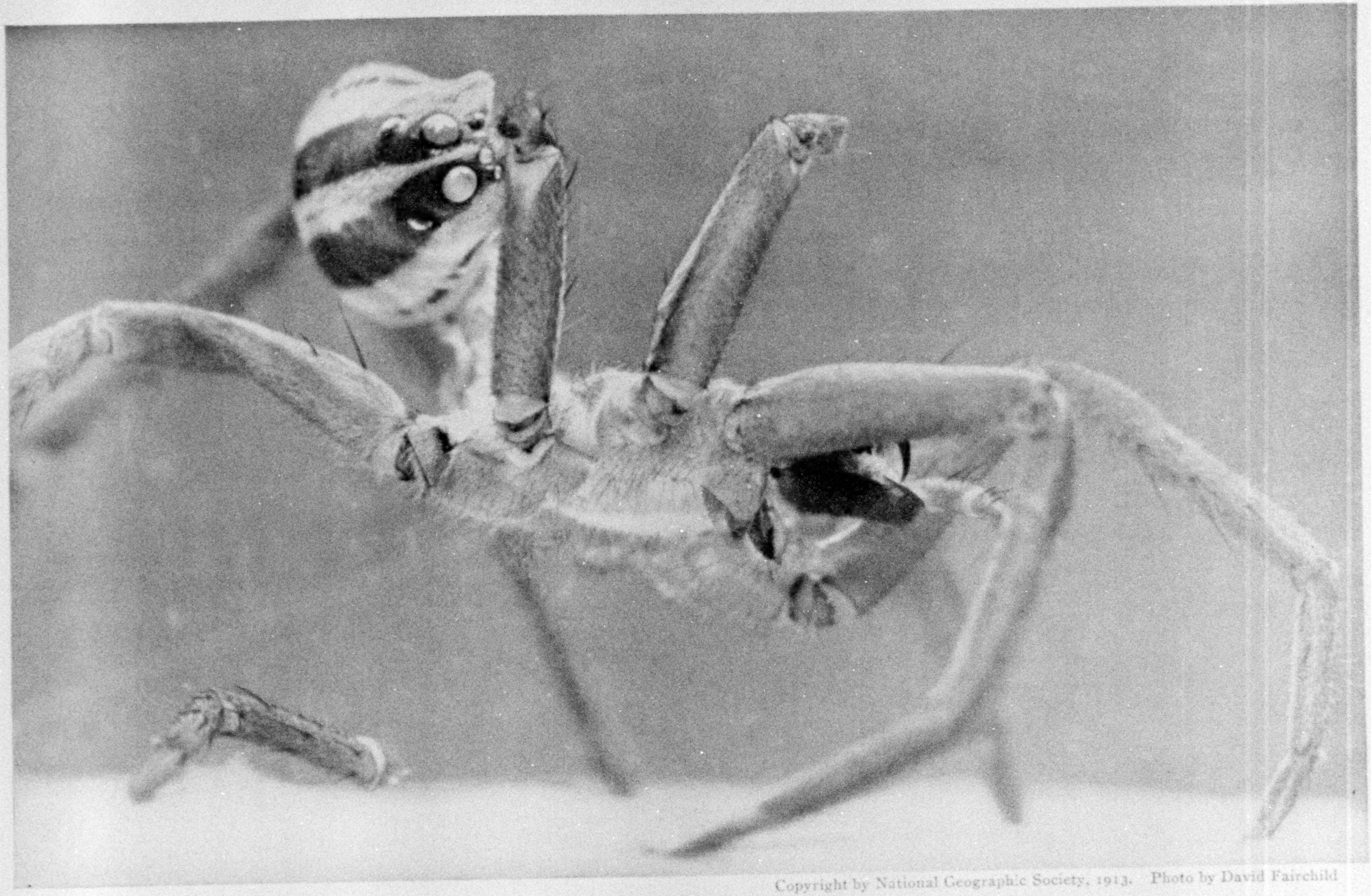
A SMALL WHITE SPIDER

This is the view we ordinarily take of the spider. Its legs and body are what we see, while its face and expression are lost, quite as much as the expression of our faces would be if only the tops of our heads were shown. This spider was taken from a mud dauber's nest and was paralyzed.



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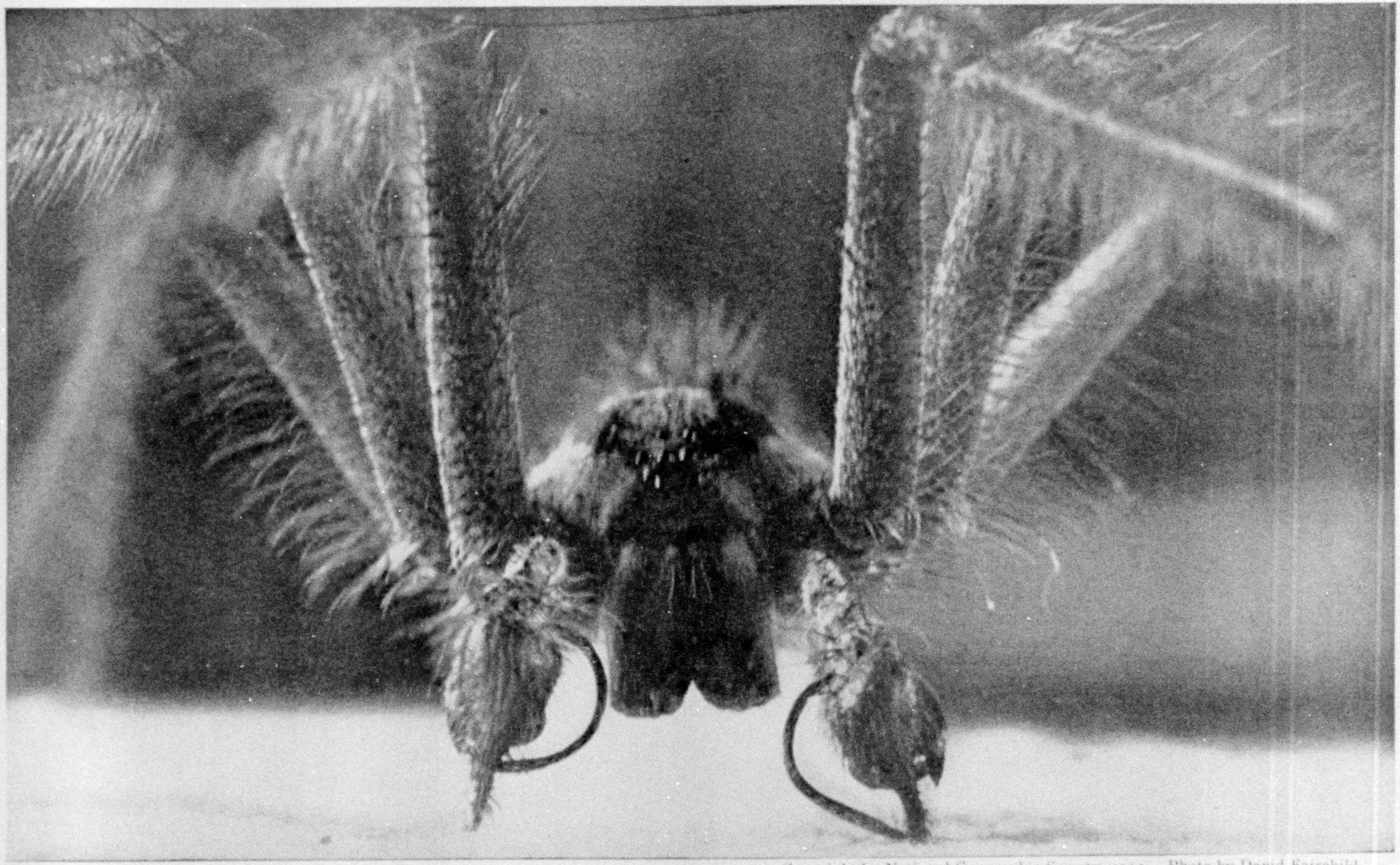
SKELETON OF A WOLF-SPIDER

It is difficult to realize that there are creatures, and many millions of them, too, which can slip out of their shells or external skeletons with little more trouble than we can change our clothes, leaving behind facsimiles of themselves more accurate than death-masks (see page 619)



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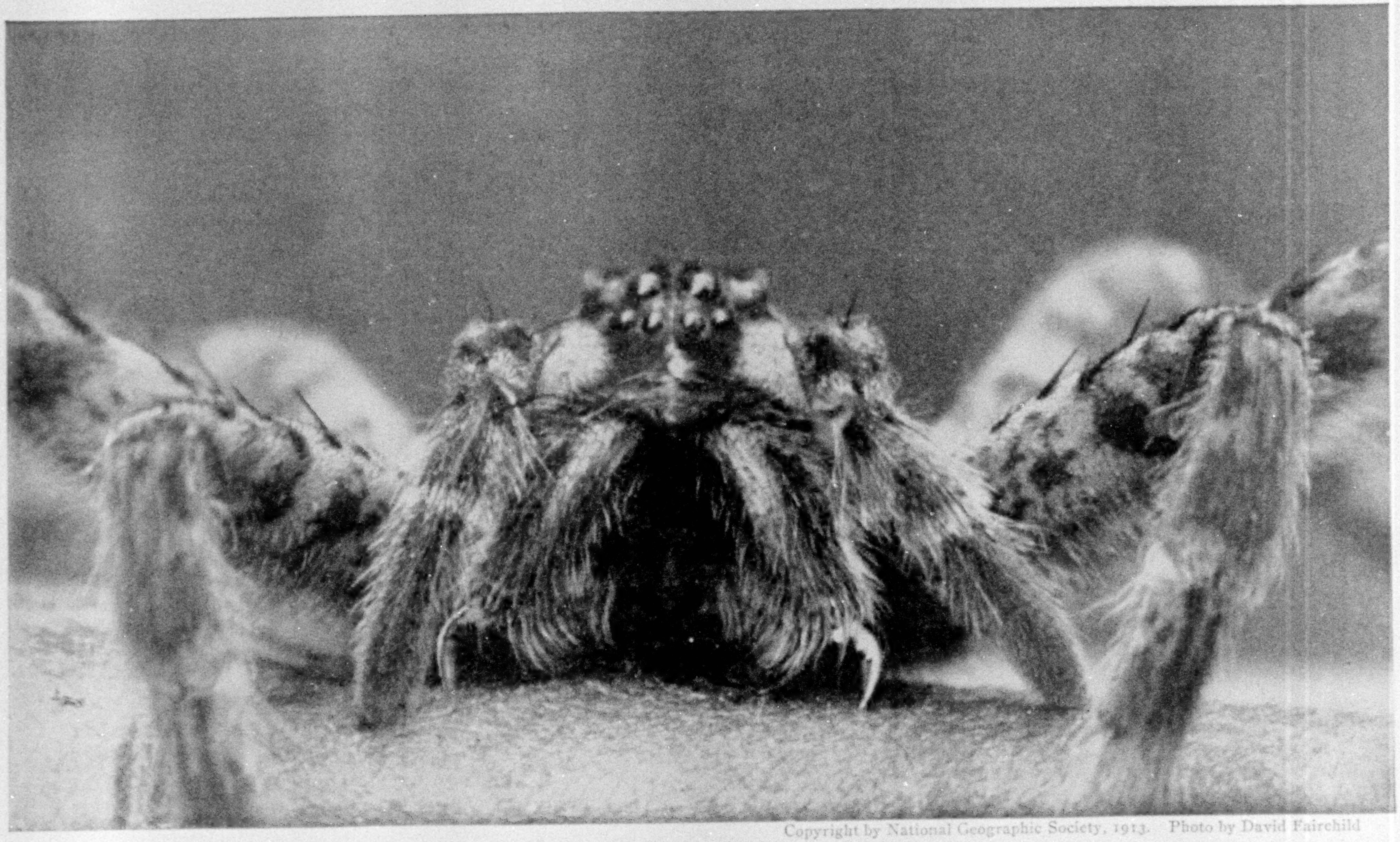
A MALE SPIDER

No discussion of the subject of sex in animals would be complete without consideration being given to the genital palpi of the male spider, strange organs of reproduction developed upon the tips of the pair of short leg-like palpi during the last moult



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A SPIDER FROM A FLY'S POINT OF VIEW

Civilized man rarely sees displayed the real ferocity of wild beasts, for even in the jungle it is hard to observe. To any one, however, who will watch a spider devour a fly, the true picture of merciless cruelty will be apparent. With its poison, sword-like fangs it first kills its prey and then with its sucking mouth-parts it sucks the soft juices out of the carcass (see page 625).

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ALL THE MONSTERS PICTURED ON THE PRECEDING PAGES, AND MANY MORE, IMPRISONED IN ONE MUSEUM CASE

They are all pinned in the box and have dried out and changed almost beyond recognition, but the impression which their portraits have made will, I hope, be lasting

grass should stumble over his own outgrown skeleton, so like his former self in all its details that he could scarcely fail to recognize it as his own; for even the transparent cornea of the eye is a part of this outer skeleton and is shed with it, as well as the jaws, sensitive spines, and hairs.

A MALE SPIDER (PAGE 623)

The long legs and low-swung body of this creature fit it peculiarly for running, and the curious structure of its short front legs, or palpi, show it to be a mature male.

A SPIDER FROM A FLY'S POINT OF VIEW (*Dolomedes tenebrosus, Htz.*), PAGE 624

A spider from the fly's point of view is a terrible monster indeed. Its claws of polished chitin, sharp as sword points, each with an aperture leading to a sac filled with deadly poison; its array of eyes of different sizes, its mottled, hairy skin covered with hollow sensitive bristles, and its powerful leg-like palpi must strike terror to the heart of any fly or cockroach which may happen in its neighborhood.

It is hard for man, who has conquered all the beasts of the forest by his superior intelligence, to realize what a struggle for existence is going on about him in the grass beneath his feet. Imagine being pursued on every hand by enemies like this, and having to be on the alert every instant of your brief existence lest you fall into the clutches of some absolutely merciless monster.

Having conquered the beasts which he can see and shoot, man is turning his attention to these minute monsters and is coming to realize their gigantic importance to the human race. Species of beetles no larger than a bird-shot have destroyed more forests than all the forest fires, and bugs no larger in size have caused an annual loss of 200 millions of dollars to the grain-growers of a single country. The fence corners, the old logs, the stone piles, the stumps, and the weeds everywhere are breeding-places for these strange creatures, and you can no more maintain a vegetable garden or run a successful orchard without making provision to protect your plants from them than a man can raise chickens in an African jungle without a dog-tight fence to protect them from the wild beasts.*

* Although perhaps not customary in an article of this character, I wish to publish my indebtedness to those who have helped to make its preparation possible; to Dr. N. A. Cobb for blazing the way by his house-fly photographs, published in the National Geographic Magazine, May, 1910; to Dr. L. O. Howard and his colleagues of the National Museum for naming the insects; to Scott Cline for developing all the negatives and making all the prints; to L. C. Crandall for making valuable suggestions; to Mr. and Mrs. Alexander Graham Bell, and Mr. Barbour Lathrop, of Chicago, for their enthusiastic support; to Miss. C. J. Aldis and Mrs. F. A. Keep for revisions of the manuscript, and to the members of the Entomological Society of Washington for their kindly criticisms during its first reading.

Although the personal pronoun has been used throughout the article, I wish to make it clear that Mrs. Fairchild is quite as responsible as I am for the taking of these photographs.

THE MONARCH OF THE CANADIAN ROCKIES

The Robson Peak District of British Columbia and Alberta

By Charles D. Walcott

Secretary of the Smithsonian Institution

ROBSON, the most majestic peak of the Canadian Rockies, is situated northwest of the Yellowhead Pass, through which the Grand Trunk Pacific and the Canadian Northern railways have been building their lines to connect the great interior plains and granary of Canada with the Pacific coast. Known to trappers of the Hudson Bay Company and a few hardy explorers who have penetrated the region in search of a practicable trail to the Pacific, the region remained almost a *terra incognita* to the outside world until Dr. A. P. Coleman described his attempts to scale Robson Peak.

Messrs. Milton and Cheadle, in their search for the "Northwest Passage by Land," * give the first graphic description of Robson Peak as they saw it from the Fraser River.

"On every side the snowy heads of mighty hills crowded round, whilst, immediately behind us, a giant of giants, and immeasurably supreme, rose Robson's Peak. This magnificent mountain is of conical form, glacier-clothed, and rugged. When we first caught sight of it, a shroud of mist partially enveloped the summit, but this presently rolled away, and we saw its upper portion dimmed by a necklace of light feathery

* "The Northwest Passage by Land," by Viscount Milton and W. B. Cheadle. Page 257. Published by Cassel, Petter and Galpin, London. 1865.

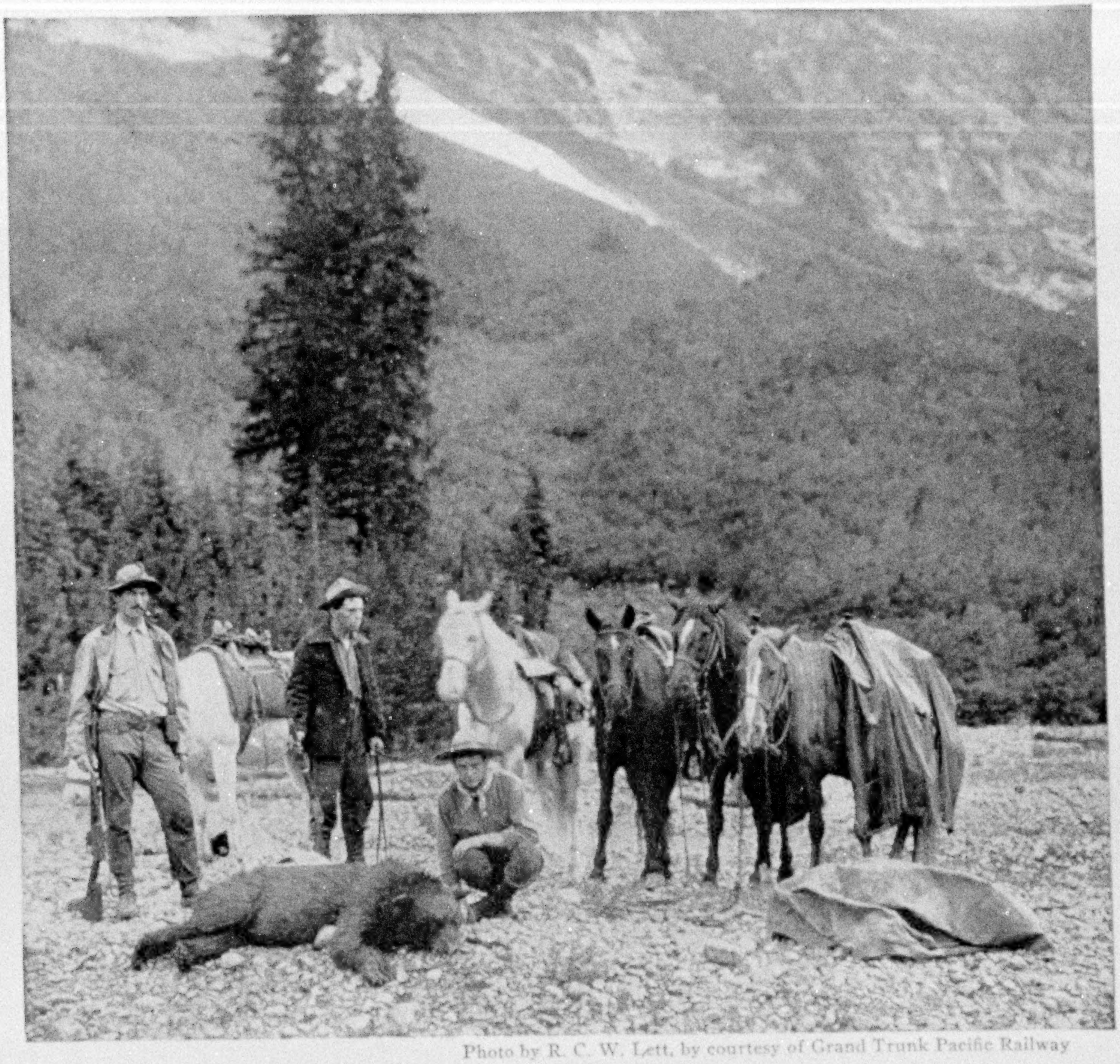

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

OUR FIRST BEAR: THE SKIN AND SKULL ARE NOW IN THE U. S. NATIONAL MUSEUM

clouds, beyond which its pointed apex of ice, glittering in the morning sun, shot up far into the blue heaven above, to a height of probably 10,000 or 15,000 feet."

Thirty-three years later (1898) Mr. James McEvoy, of the Geological Survey of Canada, made a reconnaissance from Edmonton west over the Yellowhead Pass and saw Robson Peak from the south. He fixed its geographic position and assigned it a height of 13,700 feet, stating that it has the distinction of being the highest known peak in the Canadian Rockies. McEvoy also made some geological observations, and on his map of 1901 includes the Robson region north of the Fraser River Valley as Upper Cambrian or Castle Mountain group.

THE FIRST ASCENT OF THE MOUNTAIN

In 1907 and 1908 Dr. A. P. Coleman, of the University of Toronto, began exploration with the purpose of attempting to ascend the peak. He found it impossible (1907) to climb from the south, where precipitous cliffs rose terrace on terrace from the valley of the Grand Forks 9,000 feet to the snow-clad summit.

The following year (1908) Dr. Coleman, guided by an Indian, went up Moose River and over the pass to the Smoky, reaching the foot of Robson

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

PREPARING SKINS OF SMALL GAME ON A RAINY DAY

Peak on the northeastern side. He there made two attempts to climb the mountain, but was driven back by storms and returned after enduring many hardships.

He was accompanied by Rev. George Kinney, who returned the following year (1909), and on August 13, with Donald Phillips, ascended the peak. When they reached the summit, fresh snow began to fall and soon night was gathering. It was only after incurring great risks for seven hours on the storm-swept ice and rocks that they finally descended to a place of safety and told how they had carried their flag to the highest peak in the Canadian Rockies.

Dr. Kinney later wrote that on the summit it was too cold to stop, and on the way down the danger was so great that they could not stop. Twenty hours of strenuous work brought them to their camp in the valley of Berg Lake.

Friends have asked how I happened to take up geologic work in the Canadian Rockies. The reason is a very simple one.

As a boy of 17 I planned to study those older fossiliferous rocks of the North American Continent which the great English geologist Adam Segwick had called the Cambrian system on account of his first finding them in the Cambria district of Wales. This study has led me to many wild and beautiful regions, where Nature has glorified these old sea-beds by thrusting them up into mountain masses, with forests below, and crowning them with perpetual snow and ice.

It was to learn the geology and the record of the life of Cambrian times that led and forced me summer after summer to traverse and live in those grand and beautiful Rockies.

OUR HUNT FOR FOSSILS

In the National Geographic Magazine for June, 1911, I briefly told the

Photo by Charles D. Walcott

PREPARING PTARMIGAN SKINS TO SEND TO THE U. S. NATIONAL MUSEUM

story of "A Geologist's Paradise" along the line of the Canadian Pacific Railway. During the summer of 1911 a Smithsonian expedition, in coöperation with Mr. Arthur O. Wheeler, of the Alpine Club of Canada, visited the Robson Peak district. Mr. Wheeler went to make a topographic map, and the Smithsonian party sought to obtain specimens of the animal and plant life. The resulting Wheeler map is the best one of the region, and the Smithsonian collections were enriched by a fine series of animals that include caribou, mountain sheep and goat, grizzly and black bear, many smaller animals, birds, and also many plants.

My son Charles brought back a few Cambrian fossils picked up while hunting, and told me that ridge after ridge encircled the great Robson Peak with rocky layers, all sloping back toward the mountain. This suggested an opportunity to study another great section of the Cambrian of the Rockies 200 miles (328.8 kilometers) northwest of the section of 1910.

With our party in 1912 we had Mr. Harry H. Blagden, who accompanied the expedition in 1911; also Mr. R. C. W. Lett, of the Grand Trunk Pacific Railway, who took many fine photographs the first two weeks of the trip; Sidney S. Walcott, Closson Otto, Dr. I. F. Burgin, and Arthur Brown, all of whom were qualified by experience and physique to overcome the physical obstacles and hardships of the trip.

Through the courtesy of Mr. Lett, of the Grand Trunk Pacific Railway, a set of his photographs were sent to me for use in illustrating the Robson Peak district.

WHERE THE GREAT PANORAMA WAS MADE

As we crossed the beautiful Moose Pass on the Coleman trail of 1908 (6,700

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

VIEW OF MOOSE PASS AND TAH PEAK (SEE PAGES 629 AND 635): OUR CAMP WAS IN THE FOREST ON THE RIGHT

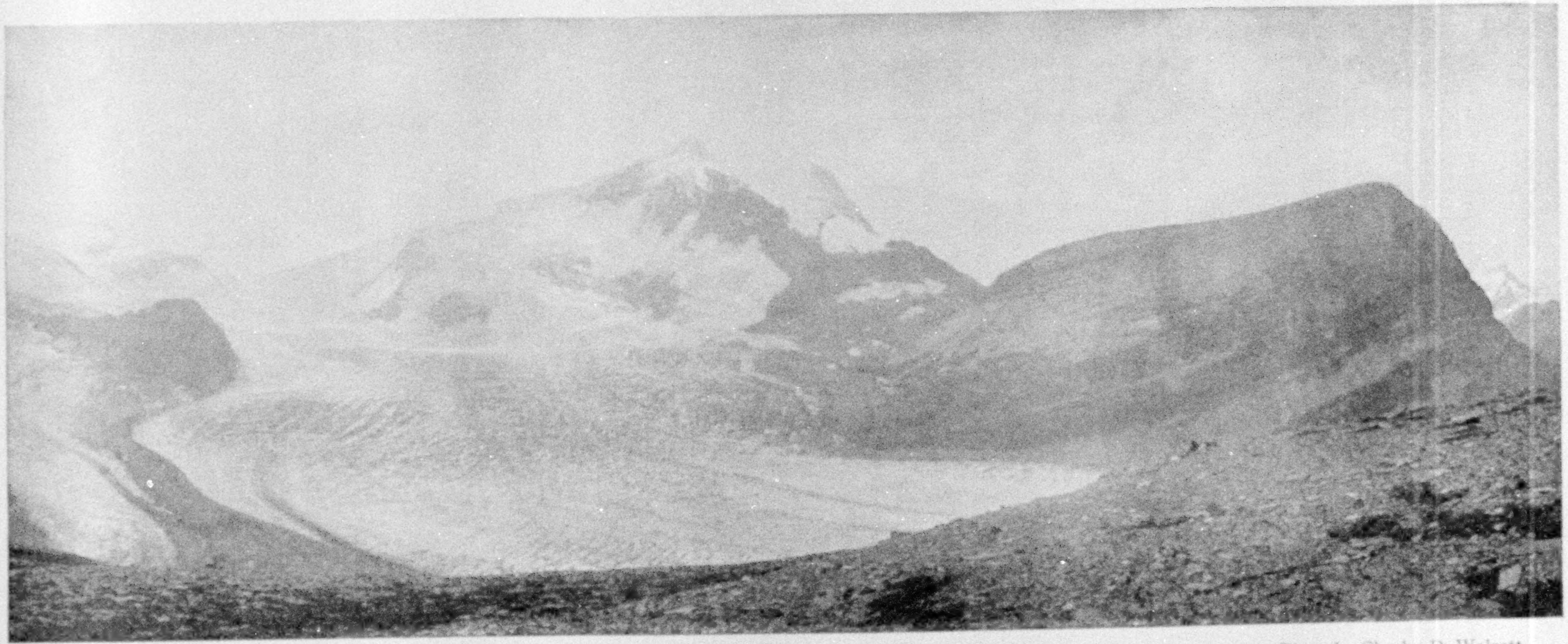

Photo by Charles D. Walcott

PANORAMIC VIEW OF THE ROBSON MASSIF AND ADJOINING MOUNTAINS, WITH THE GREAT HUNGA GLACIER IN THE FOREGROUND

The photograph was taken from a point nearly 2,000 feet above the glacier on the slope of Titkana Peak, shown in the Panorama which is published as a Supplement to this number of the NATIONAL GEOGRAPHIC MAGAZINE

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

THE HUMMOCKY SURFACE OF HUNGA GLACIER: HUNTING PARTY LOOKING FOR GOAT ON THE SLOPE OF TITKANA PEAK

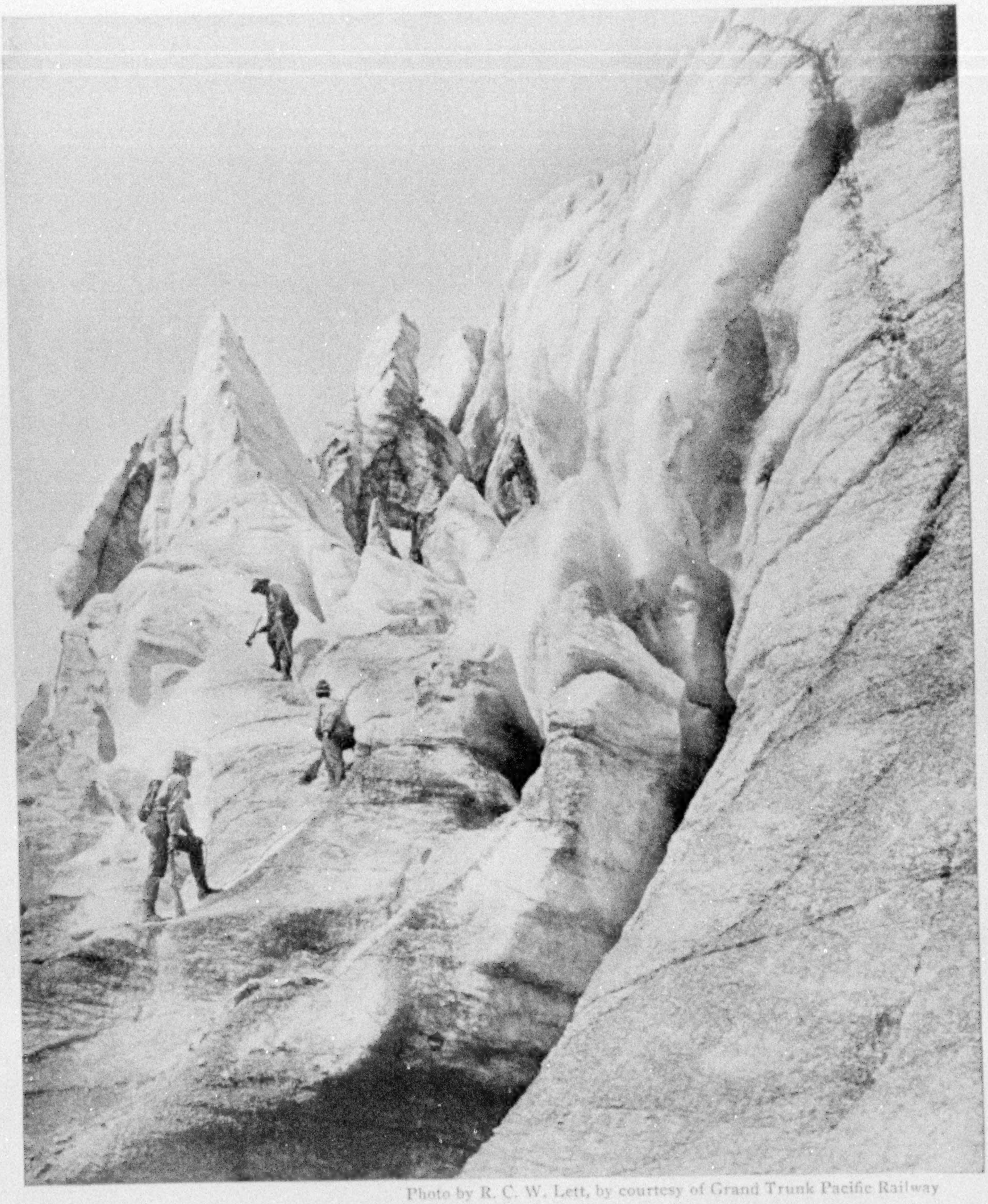

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

WORKING UP THROUGH THE VAST AND BROKEN FRONT OF HUNGA GLACIER

"Day after day we passed between these portals and climbed over the crevassed and hummocky ice in order to trace the connection of the rocky section of Titkana Peak with that of Robson. Thanks to the fine fossil fauna found in Billings Butte, and the slope of the layers of rock, a satisfactory 'tie' was made across the glacier to the limestones of Robson" (see text, page 638).

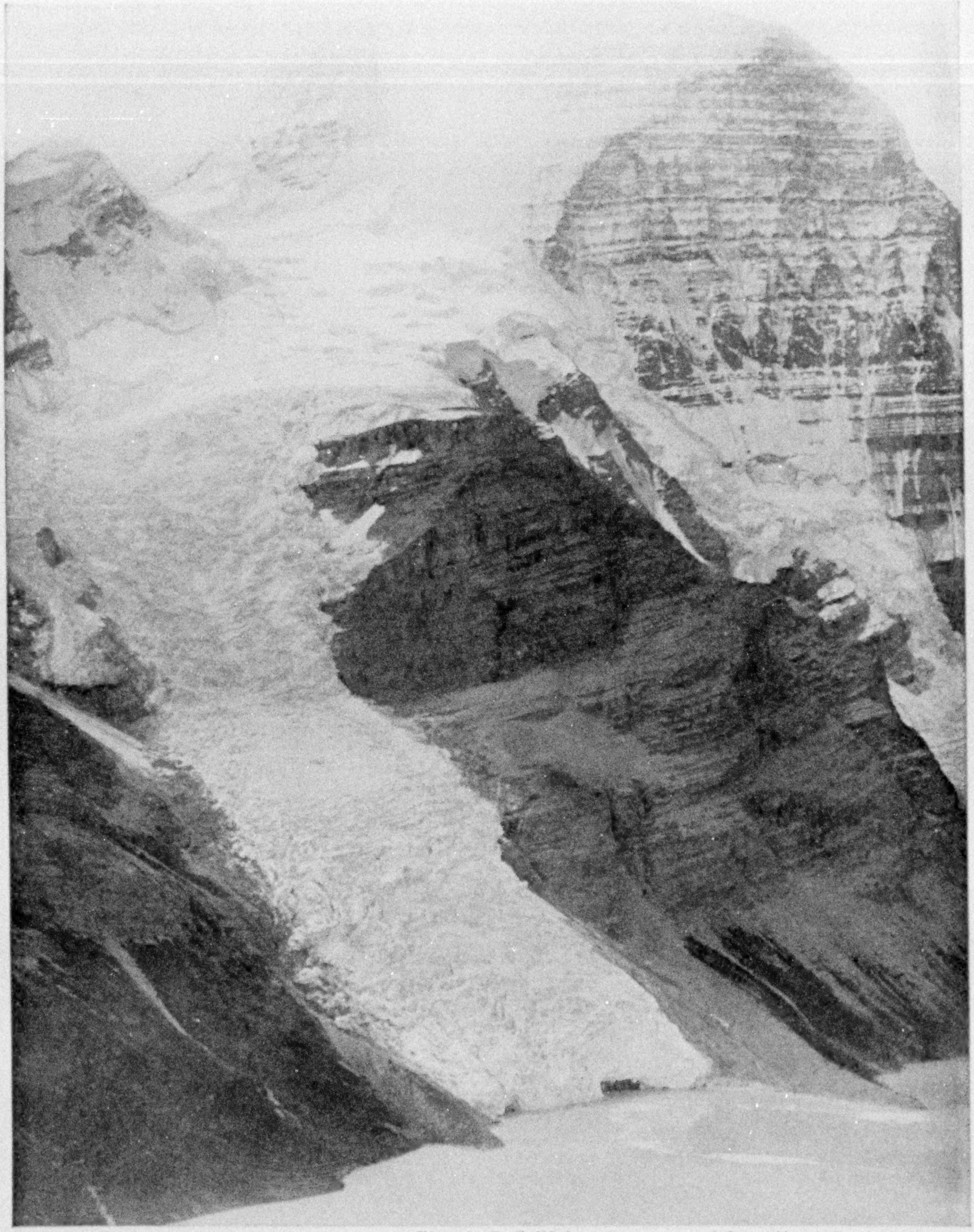

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

VIEW OF BLUE OR TUMBLING GLACIER FROM ITS NÉVÉ ON THE SLOPE OF ROBSON PEAK TO WHERE ITS FOOT ENTERS BERG LAKE, A DESCENT OF 5,000 FEET

"Blue Glacier is a wonderful stream of slipping, sheering, blue, green, and white ice. Why it does not slip and slide as a whole down into Berg Lake is one of the unsolved secrets of this great mountain" (see text, page 638).

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

A CATCH OF GOAT ON THE SLOPE OF TITKANA PEAK BELOW SNOWBIRD PASS

feet = 2,042 meters) (see page 630), I noted that the pass was on the line of a fault that had displaced and tilted up a great block of limestones and shales. Climbing a high point, Robson Peak was seen far to the southwest, with several high ridges between the pass and the peak. As the work went on from Moose Pass camp, mountains, ridges, lakes, great snow fields, and glaciers were examined, and finally we camped in the forest of Robson Pass, near the shore of Berg Lake, at the foot of the crowning glory of all—Robson Peak.

The view of Robson and its glaciers from above our camp is one of the finest views of a mountain mass that I have ever seen. By a happy combination of fair weather and a kindly disposed Al-Vista camera, the great photograph accompanying this paper was secured, and through the enterprise of your Editor it is given to all the readers of the NATIONAL GEOGRAPHIC MAGAZINE (see Supplement of this number). When the exposure was made, the camera stood on the south slope of Mumm Peak, about 1,800 feet (548.6 meters) above Berg Lake. The horses are near the edge of a cliff overlooking the lake.

Robson Peak rises majestically cliff on cliff for 7,000 feet (2,136 meters) above Berg Lake to its summit, where the vapors from the Pacific gather nearly every day of the year. At times the peak stands out clear, sharp, and glistening against the pure blue sky, but usually the mist gathers and trails about it in wisps, streamers, or solid clouds that often clothe the mountain in a mantle of white to its base.

Again, about Robson and on the summit of its northern spur—Iyatunga (black rock) (see Panorama)—the mists will gather as though impelled by a cyclone funneled from the mountain top, suggesting a great volcano belching forth smoke and steam far and near.

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

EMPEROR FALLS, WITH ROBSON PEAK ABOVE (SEE PAGE 639)

"The waters flowing from beneath Hunga Glacier form two streams, one on either side of a rocky knoll near the left face adjoining Titkana Peak. The stream at the right has formed a broad delta at the head of Berg Lake, from which the water passes through the lake and out at its foot over the cliffs into Grand Fork River, and thence by Fraser River to the Pacific."

Photo by R. C. W. Lett, by courtesy of Grand Trunk Pacific Railway

WORKING ON THE GEOLOGICAL SECTION OF THE ROBSON DISTRICT

"The geologic story of this enchanting region is too long and complicated to be related here. Suffice it that I found over 12,000 feet in thickness of Cambrian beds capped by 3,000 feet or more of Ordovician strata high up on Robson Peak" (see text, page 639).

THE GREAT GLACIERS ON THE MOUNTAIN

The profile of the peak on the northwest (about 45°) is finely shown in the great photograph. On the western side the slope is 8,800 feet (2,679 meters) from the summit to the floor of the valley above Lake Kinney. On the east and southeast the upper 3,000 feet (947.4 meters) are very precipitous, but on the more gentle slopes below, the snow gathers to form the névé of the great Hunga (Chief) Glacier.

The snow clings to the steep sides of the upper peak in long ribbons quite to the crest; gathering below, it forms a névé, which pushes out and divides into two streams of ice that fall and slip down the steep inclines for nearly a mile. The stream on the left forms Blue Glacier* and on the right Chupo (mist) Glacier. Blue Glacier extends two miles (3.2 kilometers) in horizontal distance and has 7,000 feet (2,210 meters) vertical descent between the snow cornices of Robson and its foot, where the ice is thrust into the water to break off and float away as small bergs. Blue Glacier is a wonderful stream of slipping, sheering, blue, green, and white ice. The details of its marvelous descent are beautifully shown on page 634. Why it does not slip and slide as a whole down into Berg Lake is one of the unsolved secrets of this great mountain.

Chupo, the glacier of fog and mist, is usually half concealed by clouds and banks of mist that form on the edge of the mountain and drift over it. It is not comparable in size and beauty with Blue Glacier, but it proved of great interest and service to us in our geologic work. On its surface blocks of rock from high up on the peak were carried down to the great moraine at its foot, and in those blocks I found the evidence that proved the upper third of the mountain to be of post-Cambrian age by the presence in the limestones of marine shells and fragments of crab-like animals that lived in so-called Ordovician time.

Directly above Blue Glacier a point of rock was named by Dr. Coleman "The Helmet," and the great black mountain in the center, which he called the "Rear-guard," is now given the Indian name of Iyatunga (black rock). Four thousand feet (1,263.1 meters) lower than Robson, Iyatunga rises dark and massive above the milky white Berg Lake and the great ice river on its left.

A FLOWING RIVER OF ICE

The beautiful Hunga Glacier is literally a flowing river of ice. In the large photograph (see Supplement) we see nearly three miles of the length of this glacier, and on page 632 its upper half of névé and tributary fields and slopes of snow and ice are shown from Mount Resplendent to Robson. At the foot of Hunga Glacier, on the left, Titkana* (bird) Peak rises as a black limestone mass that with Iyatunga* forms the mighty portals of the great glacier.

Day after day we passed between these portals and climbed over the crevassed and hummocky ice (see page 633) in order to trace the connection of the rocky section of Titkana Peak with that of Robson. Thanks to the fine fossil fauna found in Billings Butte, and the slope of the layers of rock, a satisfactory "tie" was made across the glacier to the limestones of Robson.

The work was trying and tedious, but Nature kindly assisted by bringing down long trains of boulders on the ice of the glacier. From these was revealed the story concealed in the cliffs far above, and thus we learned the geologic history of the rocks connected with that of the more accessible cliffs on the opposite side of the glacier.

Back on the horizon line between Iyatunga and Titkana there is a fine point that I am calling Phillips Mountain, in recognition of Donald Phillips, who made the ascent of Robson with Dr. Kinney. From its crest a glacier slopes down for a mile and a half to the edge of the cliffs west of Snowbird Pass. It is such a fine example of a small and complete glacier from névé to foot that I think it worthy of the name Chushina.

* Coleman. Account of expedition of 1908.

* Names approved by Geographic Board of Canada, December, 1912.

It was along the slopes below this glacier that our party met a band of mountain goat, affording museum specimens as well as food for hungry men and dogs at camp (see page 635).

THE STREAMS THAT FLOW FROM THE GLACIERS

The waters flowing from beneath Hunga Glacier form two streams, one on either side of a rocky knoll near the left face adjoining Titkana Peak. The stream at the right has formed a broad delta at the head of Berg Lake, from which the water passes through the lake and out at its foot over the cliffs (see page 636) into Grand Forks River, and thence by Fraser River to the Pacific.

On the left the second stream finds its way to Adolphus Lake, and thence down the Smoky, Peace, and Slave rivers to Great Slave Lake and out through the Mackenzie River to the Arctic Ocean. Sometimes the water of the left-hand stream flows across the broad flat of Robson Pass at the foot of the glacier and enters Berg Lake. On warm days the surface streams on the glacier part and send their waters to the two streams below.

The geologic story of this enchanting region is too long and complicated to be related here. Suffice it that I found (see page 637) over 12,000 feet in thickness of Cambrian beds capped by 3,000 feet or more of Ordovician strata high up on Robson Peak.

A new fossil find was made by chance. Mr. Harry Blagden and I were sitting on a huge block of rock at the lower end of Mural Glacier, munching our cold luncheon, when I happened to notice a block of black, shaly rock lying on the ice. Wishing to warm up, for the mist drifting over the ice was cold and wet, I crossed to the block and split it open. On the parting there were several entire trilobites belonging to new species of a new subfauna of the Lower Cambrian fauna.

There were also some fine marine shells of a kind that occurs in the Lower Cambrian rocks west of St. Petersburg, Russia. We found the bed from which this block had come by carefully tracing fragments of the shale scattered on the upward-sloping surface of the ice to a cliff two miles away. Working until late in the afternoon, we carried all we could pack of the rock over the glacier and down through the cliffs to the valley of the Smoky River.

One of our horses had taken leave on his own account, so we loaded faithful Billy with the rock specimens, two rifles, two shotguns, a camera, and our raincoats, and plodded over the muddy trails, forded two icy-cold rivers, and "dropped in" at camp three hours after dark. At the last ford the powerful animal carried us both and all our impedimenta through the broad, rushing glacial stream.

If all is well, I hope to return during the summer of 1913 and spend many weeks in the midst of this area of the "Geologist's Paradise." Meantime if any readers of the National Geographic Magazine wish to visit Robson Peak, they can readily do so by going to Edmonton and thence by railroad to Mount Robson Station, which is in sight of Robson Peak. The Alpine Club of Canada is planning to have its next summer camp on the shores of Berg Lake, and soon this wonderland will be open to all who love the mountains and the outdoor life.

A limited number of copies of Dr. Walcott's beautiful panorama of Mount Robson and its glaciers, which is published as a Supplement to this number, have been printed on heavy artist's paper suitable for framing, and may be obtained, unfolded, at 50 cents per copy at the office of the National Geographic Society.

The panorama was engraved and printed by the Matthews-Northrup Company of Buffalo, New York.

XUM

Photo by Ethan C. Le Munyon

PASSING THROUGH THE NATIVE STREET OF KALGAN

The foreigner on the horse is Mr. Heininger, a missionary of Kalgan, who kindly helped to keep the curious natives clear of the car when it passed through the main street of Kalgan. They had never before seen a motor-car.

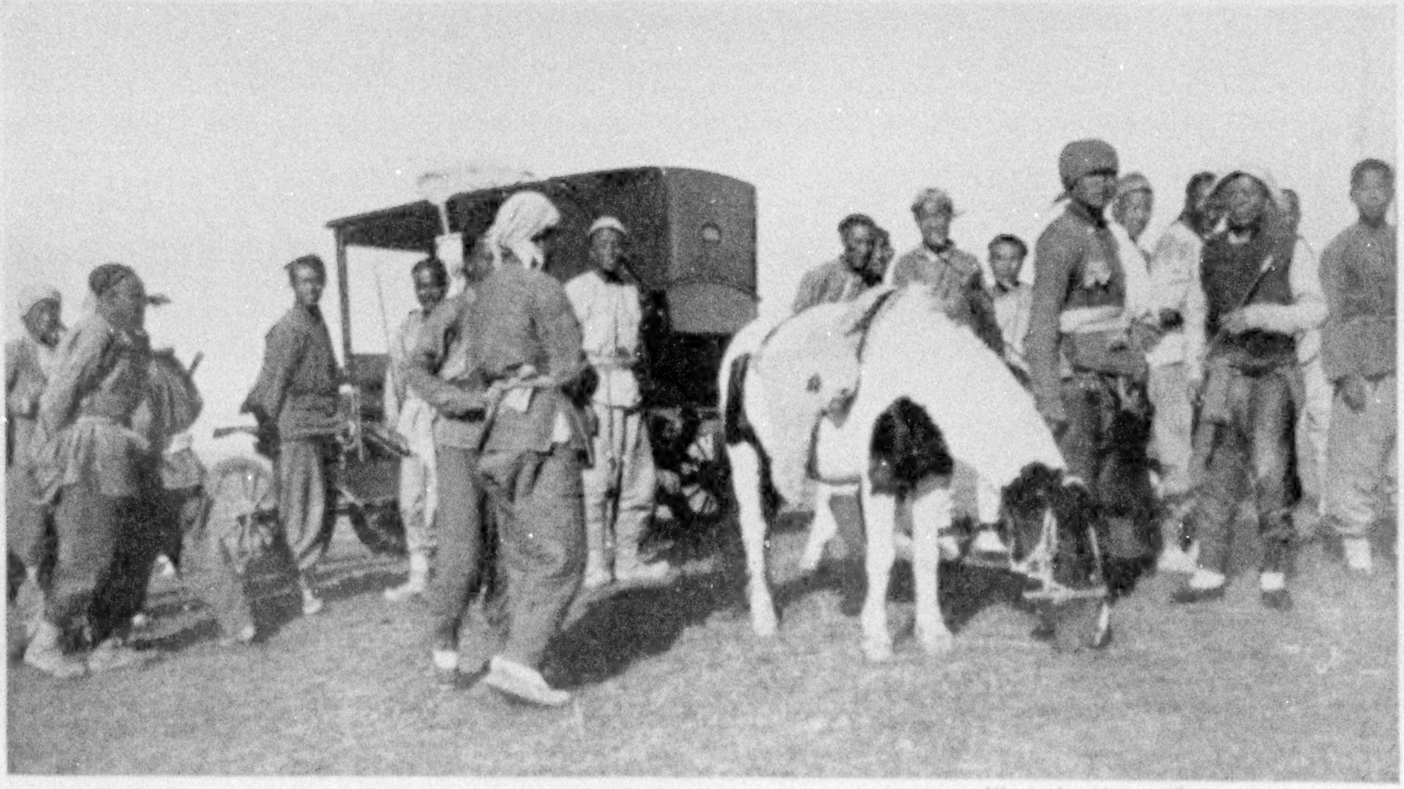

Photo by Ethan C. Le Munyon

INTERESTED CHINESE GATHERED AROUND THE CAR

Some of them termed it a "che chu" (breath cart), and all wanted to know what made it go

THE LAMA'S MOTOR-CAR

A Trip Across the Gobi Desert by Motor-Car

BY ETHAN C. LE MUNYON

OF ALL the strange places and strange people into whose hands American motor-cars find their way, perhaps the strangest or least known of all is "Gigin," whom all Mongolians call "The Living God," or "Bogdo."

This personage is known among foreigners as the "Tasha Lama," or Living Buddha; he is second only to the Dalai Lama of Tibet in importance in Lamaism. In Mongolia he is both the religious and the political head of the country and is recognized and venerated by all the inhabitants of Mongolia as sacred.

The city of Urga, where he dwells, has, up to recent years, been one of the cities of Asia forbidden to the foreign traveler, it being second in importance to the forbidden city of Lhasa, Tibet, the dwelling-place of the Dalai Lama and the capital of the northern Buddhist faith.

Some months ago an American firm in Tientsin, China, was commissioned by the agent of the Buddha to obtain for him a closed type of motor-car, the Buddha having heard it rumored among his priests, or lamas, in Urga that such things could be obtained from the foreigners.

After giving the matter due consideration as to the make of car best suited to the needs of the Buddha, whom we shall call "The God," as it is by that name that he is known in China and Mongolia, a popular-priced American motor-car, having the planetary type of transmission and foot control, was selected as being as near "fool-proof" as possible and best suited to the god's needs.

This type of car was chosen as being fitted to the country in which it was to be used, and also because it could be easily maintained by people who had no mechanical knowledge whatever.

The car was ordered by cable from the Detroit manufacturers and was to be a regular stock car and not a special car in any way.

Photo by Ethan C. Le Munyon

SAVING GASOLINE BEFORE REACHING THE HILL

As long as we had to have the bullocks on the hill we used them here

Photo by Ethan C. Le Munyon

STARTING UP THE "HAN OR" HILL: NOT A PLEASANT OUTLOOK

Note the camel caravan, which is loaded with cigarettes en route from Kalgan to Urga. It will take this caravan 30 days to make the trip. Each camel will carry about 300 pounds, the freight rate in this case being about 13 taels per camel, about $7.75 for the trip.

It was received in Tientsin during the last week of September, 1912, and was set up and placed in working order immediately and driven round the streets for two or three days to test out the working parts. It was then placed on a flat car and shipped by rail to the end of the Peking-Kalgan Railway at Kalgan, the point nearest the Gobi Desert, over which it was necessary to pass to reach Urga.

The car arrived at Kalgan without incident on the afternoon of the 22nd, and was unloaded at the station and driven through the native streets under its own power, across the old stone bridge and through the crowded part of the town. The natives crowded around and it was with difficulty that we were able to move without running over some of them, as they filled the road, for in almost every case they had never seen a motor-car before and a great number had never even heard of one. One and all, they wanted to know what made it go, like the old Chinaman in the early days of railroads: "No pullee, no pushee, how fashion can makee goee."

Many hundreds of years ago these streets were originally paved with huge slabs of stone, but during the passing centuries holes have been worn in and between these stone blocks, so that in some places the wheels of the car would drop into holes 12 to 18 inches deep, and in most cases they were filled with slippery mud.

USING A RIVER-BED AS A ROAD

Leaving the city behind us, we now began the climb up the pass, the river-bed serving us as a road for about 20 miles. It was necessary for us to cross and recross the stream from time to time, for the river-bed was full of loose stone, soft gravel, interspersed with larger stones, which made progress exceedingly difficult. The grade was so steep and the road so poor we were forced to use low gear most of the way, and darkness overtook us before we had gone six miles.

To add to our discomfort, it now be-

Photo by Ethan C. Le Munyon

A SCENE NEAR THE TOP OF THE PASS

We passed these caravans frequently while in the pass

gan to rain a little; so we sought shelter at a Chinese inn for the night. A trained nurse, who was going up country with us for a distance of 90 miles, used the car as a shelter; but my companion and I managed to get in a sort of stable, covered with a leaky roof, and by using a heavy canvas which we carried, contrived to keep dry and to sleep a little occasionally.

The rain continued steadily during the night, and daylight the following morning gave very little promise of better weather. We arranged with some Chinese farmers to supply us with five bullocks to draw the car in case the river-bed should prove too soft for us to run under our own power.

About 10 o'clock the clouds lifted, the bullocks were attached to the car, and we set off up the pass, saving our own power for the bad places which the natives informed us we should run across later in the day.

It was sometimes necessary to use the entire power of the car in addition to the pulling power of the five animals to get over some of the steepest places. The road was slippery with mud, and with the loose stones and large boulders, it was almost impossible for the wheels to get a grip at all. Half way up we halted at the "Temple to the Horse" and gave the animals and ourselves a rest.

THE WATCH-TOWERS OF THE GREAT WALL OF CHINA

Looking back toward China, we could see in the distance the watch-towers of the Great Wall. These are 20 miles outside the wall proper, but were built at the same time; they are at least 150 feet square at the base and quite high.

After leaving the temple the road became even steeper and filled with sharp stones and larger rocks, so that in some places it was necessary to leave the road, wending our way in and out among the larger rocks.

Near the top the worst roads of all were passed. At times it was necessary for my companion to go ahead and sound each of the mud-holes as to depth before we attempted to go through with the car. Often he had to stand on the running-board of the car to keep it from tipping over, as the road along the side of the hill was merely a sketch and the outside

Photo by Ethan C. Le Munyon

THE "TEMPLE TO THE HORSE"

It is located about half way up the famous "Han Or" Hill, where it was necessary to use five bullocks as well as the power of the car to make the grade. The upright poles in front of the temple are of carved solid stone, the entire temple being built of stone and native brick laid in lime mortar.

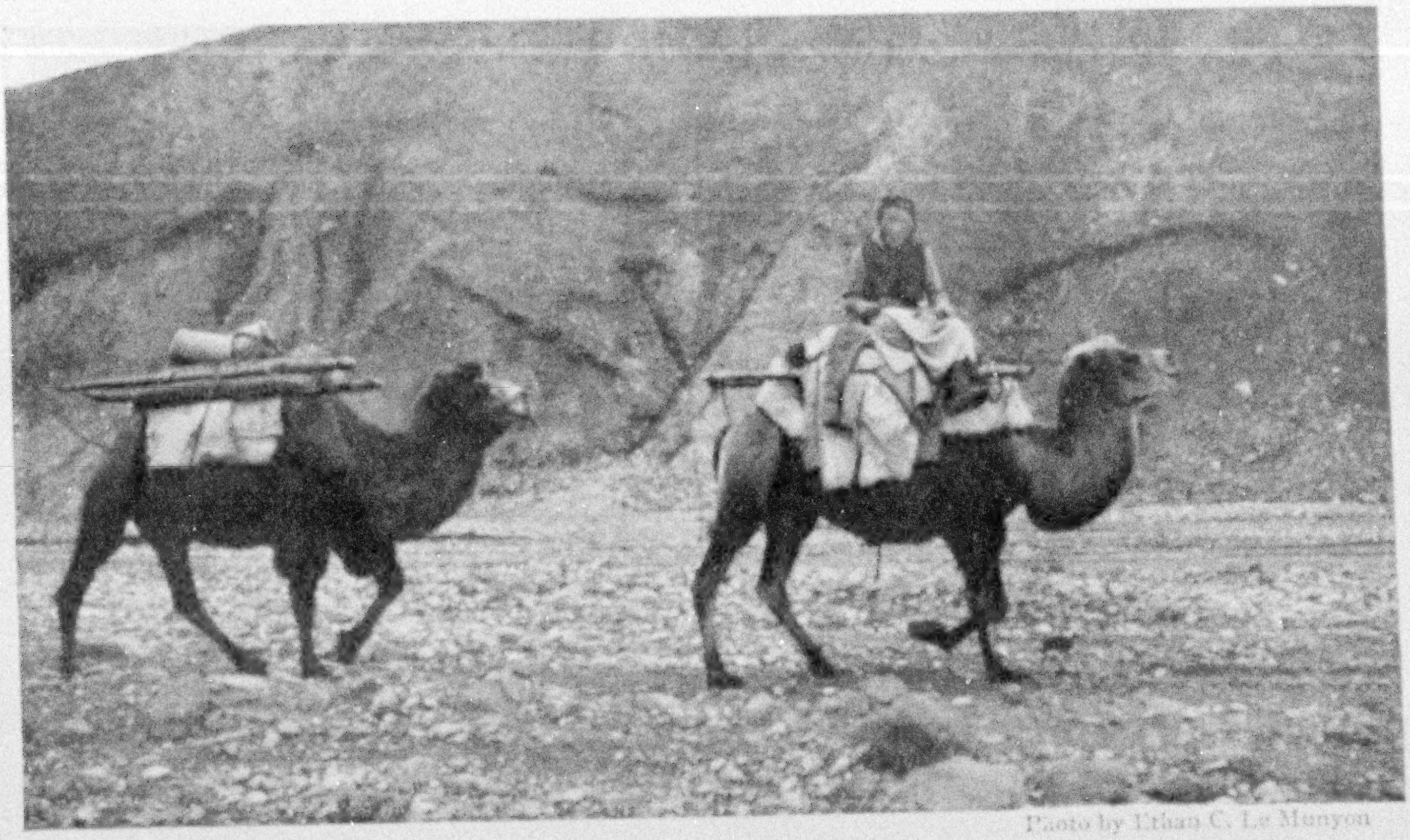

Photo by Ethan C. Le Munyon

THE OVERLAND FREIGHT CARRIERS OF ASIA

Note that the road is not a boulevard even here

track was in most cases 6 to 12 inches lower than the inside; so that the car was always on the verge of upsetting.

One of the native carts which passed us had two bullocks and two Mongolian horses hitched to it, while it carried only about 100 to 150 pounds of goods. Even with all this motive power, it was all the driver could do to get up the hill, the grade was so steep.

After crossing a sea of mud, where the ruts were not less than 8 inches deep, we arrived at a native inn. We ran the car in the yard, which was also deep in mud and refuse. Here, as at the first inn, after a great deal of "dickering" with the inn-keeper, we were given a room to ourselves.

MAKING A BED IN A CHINESE INN

In this room were several bundles of garlic and onions, pack-bags, and stores in general. There was also a "kang" (or brick bed), with a hole in the center as big as a wash-tub. After filling this hole with some of the saddlebags, we spread our ground cloth over it and made a bed. This room was next the regular room of the inn, which was about 10 by 15 feet in size, and contained one very large brick kang, on which slept about 20 Chinese and Mongols, which to us would seem impossible; but the fact remains, however, that this was the true number. After listening for a while to their jabbering, which continued all through the night, we tried to sleep, but had rather indifferent success.

The following morning we did not attempt to get an early start, as we wished the roads to dry a little if possible. We also waited for our second carter to arrive from Kalgan. The first, who was carrying our extra baggage, had only been engaged to go as far as this, for we had been told in Kalgan that the roads would be hard and dry from this point on, which they certainly were not. Carter number two put in appearance about 11 o'clock; the baggage was transferred to his cart and a start made.

During the remaining hours of daylight we made as much progress as possible, arriving at a small Chinese settlement by the name of "Meeota" (temple), where we spent the night in a much better inn.

This was a very interesting day's run, as we passed through a section of cultivated Chinese fields where grain was

Photo by Ethan C. Le Munyon

LOOKING BACKWARD DOWN THE PASS

The square towers on the sky-line are the last outposts or watch-towers and were built at the same time as the Great Wall. It is hard to realize that for 2,000 years they have stood in this position, a monument to the master mind who conceived the greatest work of man in Asia, for the Great Wall of China, with a length of over 2,000 miles, is truly one of the greatest wonders of the world. The wool, fur, and skin trade of all Mongolia enters China through this pass.

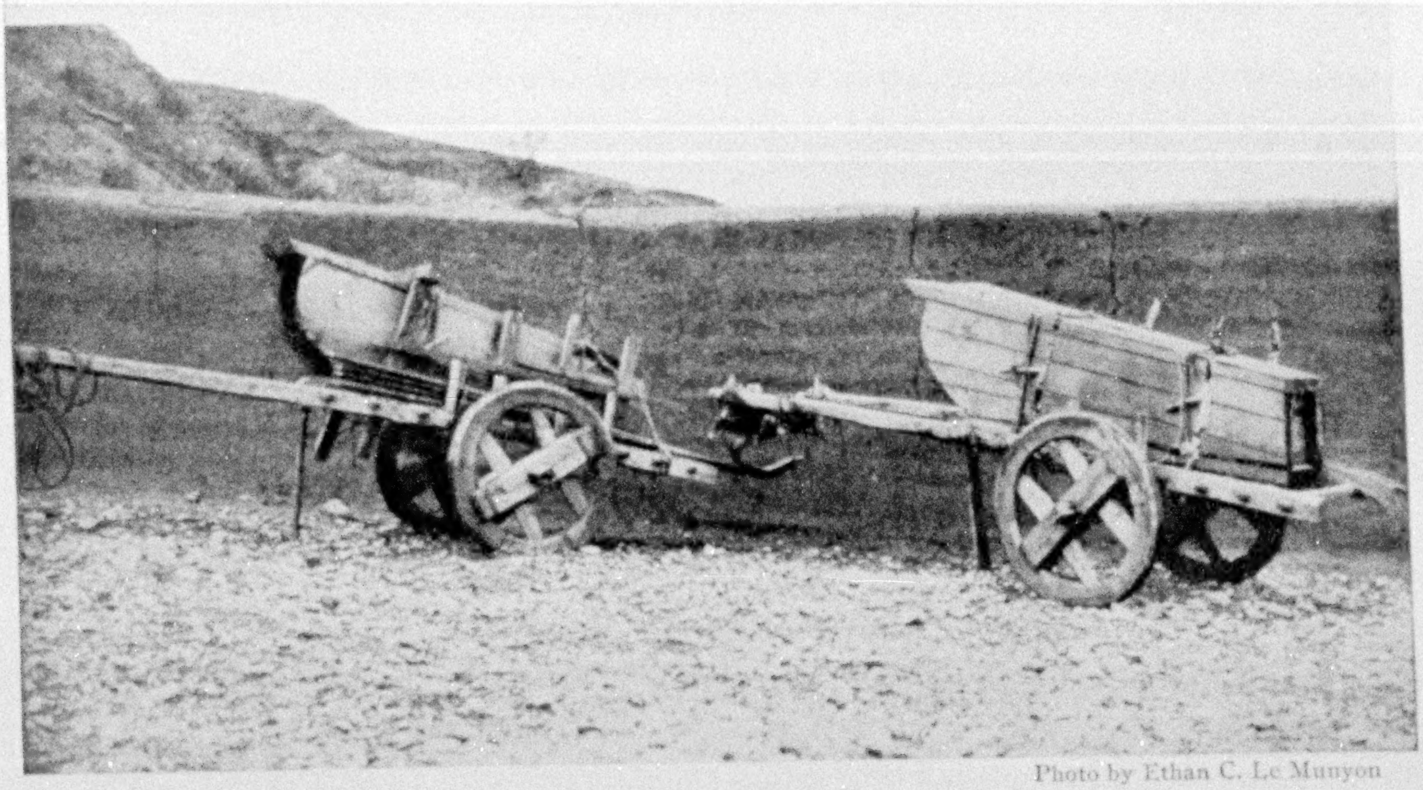

Photo by Ethan C. Le Munyon

CHINESE COFFINS LOADED ON CARTS AND STANDING JUST OUTSIDE THE INN YARD

Note that the wheels of the carts are of wood only and have no iron tires. In fact, no iron is used, wooden pegs serving the same purpose as nails

growing. There was a great collection of sheep and camels in the inn yard awaiting shipment to China. When we were leaving the following morning, all the women of the town lined up at the gate.

The country through which we were now passing was an almost flat plain, with rolling hills showing against the horizon. The soil in this section was also very poor, free alkali showing in many places, and the grasses and bush were not unlike those of our own great Southwest. We were now beyond the cultivated region and were entering the barren country at the beginning of the Gobi Desert.

THOUGHTFUL PROVISION FOR GHOSTS

Soon after we passed a couple of Chinese graves, each of which had a small hole in the end, so that the spirit could pass in and out at will.

About noon we came in sight of the last river which we would have to cross. We made a run for it and got as far as the middle of the stream, but the mud in the bottom got the best of us and we stuck. We were, however, prepared for just such a case as this, and had provided the car with a set of small iron tackle blocks before leaving Tientsin, and carried an iron rod, which was driven in the dry bank of the stream; and as we had a long length of rope, it was only necessary for us to thread up the pulley blocks and to pull the car out, with the help of a couple of Mongols who happened to come along at that time. When we stuck in the stream the water was over the muffler, and we did not dare stop the engine lest we could not start again, as the water was just to the bottom of the carbureter.

We were now freed from troubles of this sort until we reached the Tola River, just in sight of Urga. As we had plenty of water here we washed the car, removing some of the mud, which stuck like cement, as it had been on for three days from the time we entered the wet clay on the way up the pass. We had lunch and drove on about a mile further, where our carter came up with us and unloaded our baggage. We paid him off in lumps of silver, called "sycee," which was weighed out in small pocket scales, which are always carried when traveling in Mongolia. The baggage was now transferred to the machine and, after giving

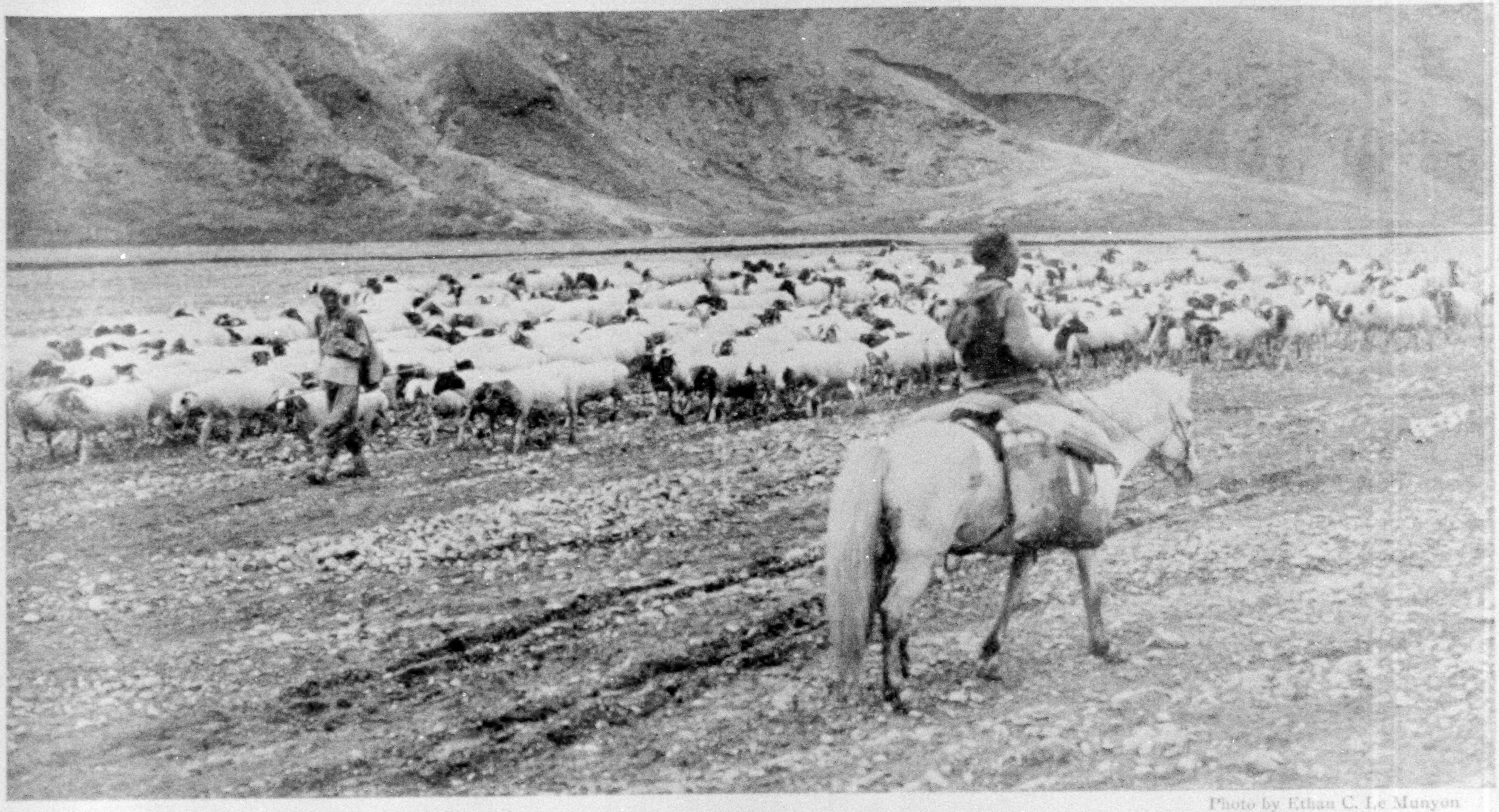

Photo by Ethan C. Le Munyon

MUTTON BOUND FOR PEKING VIA KALGAN

It is driven in on the hoof, the skins and the wool in many cases being shipped to America. This wool is suitable only for carpet use. The larger percentage of carpet wools come from China

Photo by Ethan C. Le Munyon

TRANSFERRING THE BAGGAGE FROM THE CHINESE CART TO THE AUTOMOBILE; ALSO SETTLING WITH THE CARTER FOR HIS SERVICES

The foreigner in the white shirt—my companion on the trip—is weighing out the lump silver (*sycee*) to pay the carter the proper amount. The lady in the picture is a trained nurse who traveled a distance of 90 miles into Mongolia to call on some friends. This is the place where we bade farewell to the Chinese. The roads are much better here, hard but very rough. With our additional baggage we had a very heavy load.

trade tobacco to some of the Mongols who had assisted us, we took to the road again. The roads were now in much better shape; they were dry and not very smooth, but this was much better than mud.

Soon we stopped at a well to replenish our water supply. This was a dug well about 70 feet deep. The bucket was a piece of untanned bullock hide, with the hair on the inside, and every time we drew water some of the hair would come off. Americans might not consider it quite sanitary.

The days are warm and sunny here, but the nights are so cold that it was necessary for us to drain the radiator of the car to keep the pipes from bursting. From that time on we had to do this every night until we reached Urga.

Late on the following day we passed over a level plain and several herds of antelope were sighted; they were scared at the motor-car and we could not get very near to them. Soon we entered the barren plain and stopped the car to speak to the driver of a camel-cart.

THE OVERLAND LIMITED OF THE DESERT

These camel-carts are the "overland limited" of the desert and are used as passenger conveyances. The body of the cart is covered with heavy felt, which will defy the coldest weather, and in all they are quite comfortable, if one can only forget that there are no springs under them.

Pangkiang, the first telegraph station, was reached about dark. Here we found the first 10 gallons of the gasoline which we had sent forward from Tientsin a couple of weeks before shipping the car. The supply was transhipped at Kalgan and forwarded to Urga by camel cara-

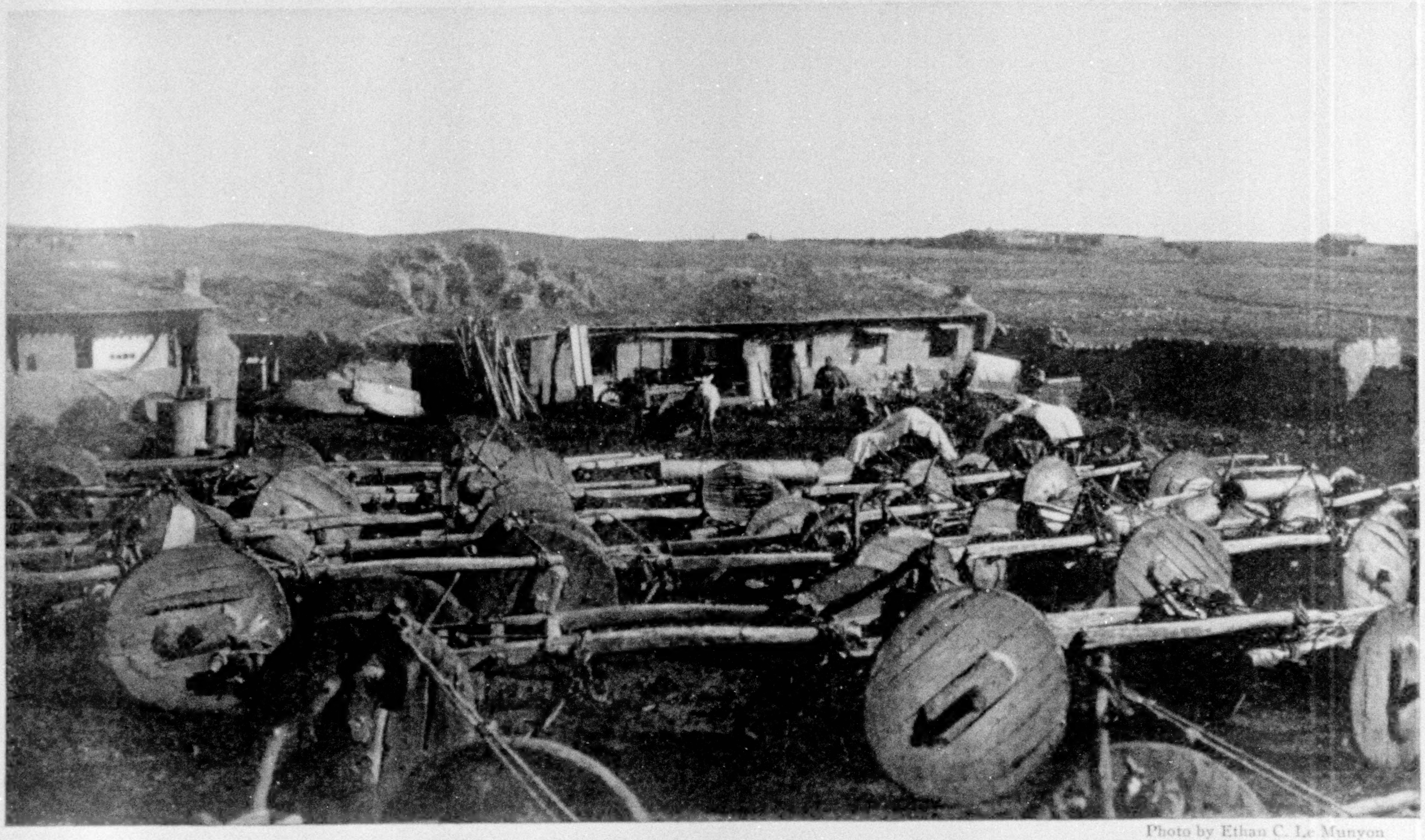

Photo by Ethan C. Le Munyon

A CHINESE INN YARD: MONGOLIA

This is where all travelers in this part of the country have to stay over night if they want a roof over their heads, poor as it may seem. The Chinese are yearly moving farther and farther into Mongolia, raising grain and other food-stuffs. The Chinese cultivated fields extend outward into Mongolia about 70 miles from Kalgan. While the season is quite short, the soil is very rich and productive and will support many of the millions who at present live in the crowded cities and villages of China.

Photo by Ethan C. Le Munyon

CHINESE GRAVES NEAR THE ROAD

The hole is to let the spirit of the deceased in and out at will. This is a rather lonesome place—a sort of alkali country

Photo by Ethan C. Le Munyon

THE WRITER DRAWING A BUCKET OF WATER AT A NATIVE MONGOL WELL

The windlass and rope are removed from the stone-post and taken into the tent of the Mongol owning the well. Wood is very scarce, and it would never do to leave this amount where it could be stolen. The bucket in this instance is a piece of untanned cowhide with the hair left on, and on the inside of the bucket too. The hide is sewed up the side and holds probably two American gallons. Of course a quantity of hair comes out each time the bucket is emptied. As this one had been in use some time, the odor was not pleasant. However, it was the only way to get water and we had to have it. The well is a dug well, about 70 feet in depth.

Photo by Ethan C. Le Munyon

A GROUP OF NATIVE CHINESE WOMEN AT THE LAST CHINESE SETTLEMENT, CALLED "MEEOTA," WHERE THERE WAS AN INN: NOTE THE SMALL FEET

van, with instructions that a tin of 10 gallons was to be left at each of the three telegraph stations, which were about an equal distance apart across the desert.

The Chinese who was in charge of this office spoke English and entertained us in the guest-room, which is always reserved for officials traveling on government business in Mongolia. The Chinese government operate a telegraph line across the desert from Kalgan, in China, to Kiachtka, in Siberia. The altitude at this point is 5,600 feet. We were now 180 miles from Kalgan, and in this one day we had made a distance of 90 miles.

We were now on the actual Gobi Desert, and at times found the roads very, very sandy, so that it was impossible to make good time. At a well we took a few photos of the native women and also of a lama. The lamas have their heads shaved, but the ordinary Mongols wear a queue like the Chinese. Their features are very different from the Chinese and both sexes are filthy beyond description. About 98 per cent of these natives never bathe from the cradle to the grave.

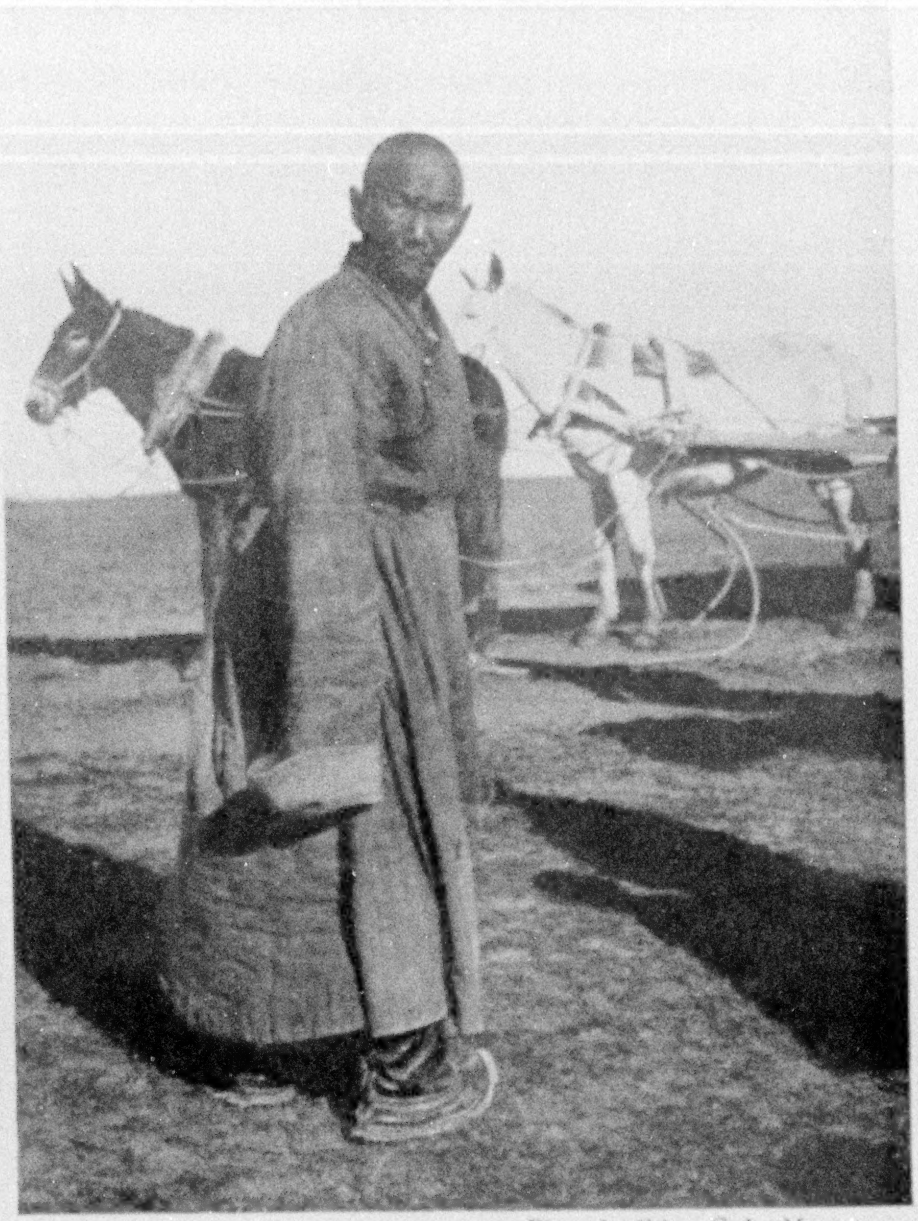

Photo by Ethan C. Le Munyon

A TYPICAL MONGOLIAN LAMA: THESE LAMAS ARE THE PARASITES OF MONGOLIA

Later in the day we came upon a Mongolian temple, which was patterned more after the Tibetan style of architecture. There were a great many dirty lamas living there.

THE TELEGRAPH IN THE DESERT

Night overtook us when we were passing through a very bad stretch of rocky, mountainous country, and, rather than risk the car and our necks, we stopped the car at the side of the road and spent the night where we were.

Udde, the second telegraph station, located at an altitude of 3,000 feet and situated at the foot of a small mountain almost in the exact center of the desert, was the next stopping place; it was 328 miles from Kalgan. Here we disconnected the muffler from the car, as we had no "cut-out," so that if it was possible to save fuel and keep the engine cool we could try our best to do so. That afternoon we traveled on some comparatively good roads, but as they were full of small holes, fast running was out of the question. About dark we came up with a caravan and spent the night in one of their tents, we having none.

The following day we disturbed several herds of antelope and managed to get one. We estimated that in one of the

Photo by Ethan C. Le Munyon

THE OLD AND THE NEW

A unique picture and probably the only one of its kind ever taken. The actual setting is in the middle of the Gobi Desert. The camel cart is the "Overland Limited" of the Gobi, and is the most luxurious method of transportation there. The cart is covered with heavy felt and is quite warm even in the coldest weather. It has no springs and sometimes tips over. The swaying motion is very much like a small boat in a heavy sea. The automobile here travels as far in one hour as the cart in a day. Twenty-five miles is a good day's travel for the camel cart.

Photo by Ethan C. Le Munyon

A GROUP OF CURIOUS NATIVES GATHERED AROUND THE CAR

droves there must have been at least 500. We began a climb of over five miles, to a grassy plain about 30 miles wide; here the road was scattered with the bleached bones of cattle that had died by the way and also of other animals. About dark we stuck in the sand of a river-bed and had to dig ourselves out. This caused a delay of a couple of hours, so that we were forced to sit up in the car that night, as it was raining a little and very cold, and we dare not go on, as we were, of course, not familiar with the trail, and even in daylight we lost the way two or three times, as the beaten path was not very well marked.

During the night a string of 90 bullock carts passed us, bound for Kalgan, loaded with small hewn logs to be used for lumber; this had come all the way from the other side of Urga. It would take at least 30 days for them to reach Kalgan, as they could only make about 15 to 20 miles per day, because the bullocks had to get their living from the country and, of course, had to be pastured during the daytime.

The following day we reached Sume, which consists of the two temples and their outbuildings and forms one of the largest and most important lamaseries in outer Mongolia. The altitude here is 4,800 feet. There are about 2,000 lamas living here, some quite young, as Sume is an important theological school.

This lamasery, or monastery, is a town in itself and very interesting. Lamas may be seen here of all ages and degrees of filth. On the tops and corners of the temples are prayer-wheels covered with gold leaf; these contain long prayers written on rolls of script, the wheels revolve in the wind, and the results of these special prayers are said to be as satisfactory as those offered by any other method, either ancient or modern.

WHAT THE LAMAS ARE LIKE

Every third man in Mongolia is a Lama. Some live in *yurts*, or tents, with and on their relatives, while others live in the temples. The temple lamas are of the lower type; they are coarse and filthy and much inferior, both morally and physically, to the tent lamas. They are not unlike those sometimes seen by travelers in the Lama temple at Peking, China. The lamas living in tents among the people are of a better class and are much respected and looked up to all over Mongolia.

We had now taken on our last tin of gasoline and were on the "home stretch." We had to drive against a strong head wind, and were it not for our heavy fur coats we would have suffered greatly from the cold. The wind blew so hard that on the up grades it was almost impossible to drive the car in high gear and make speed. On this high, grassy plain

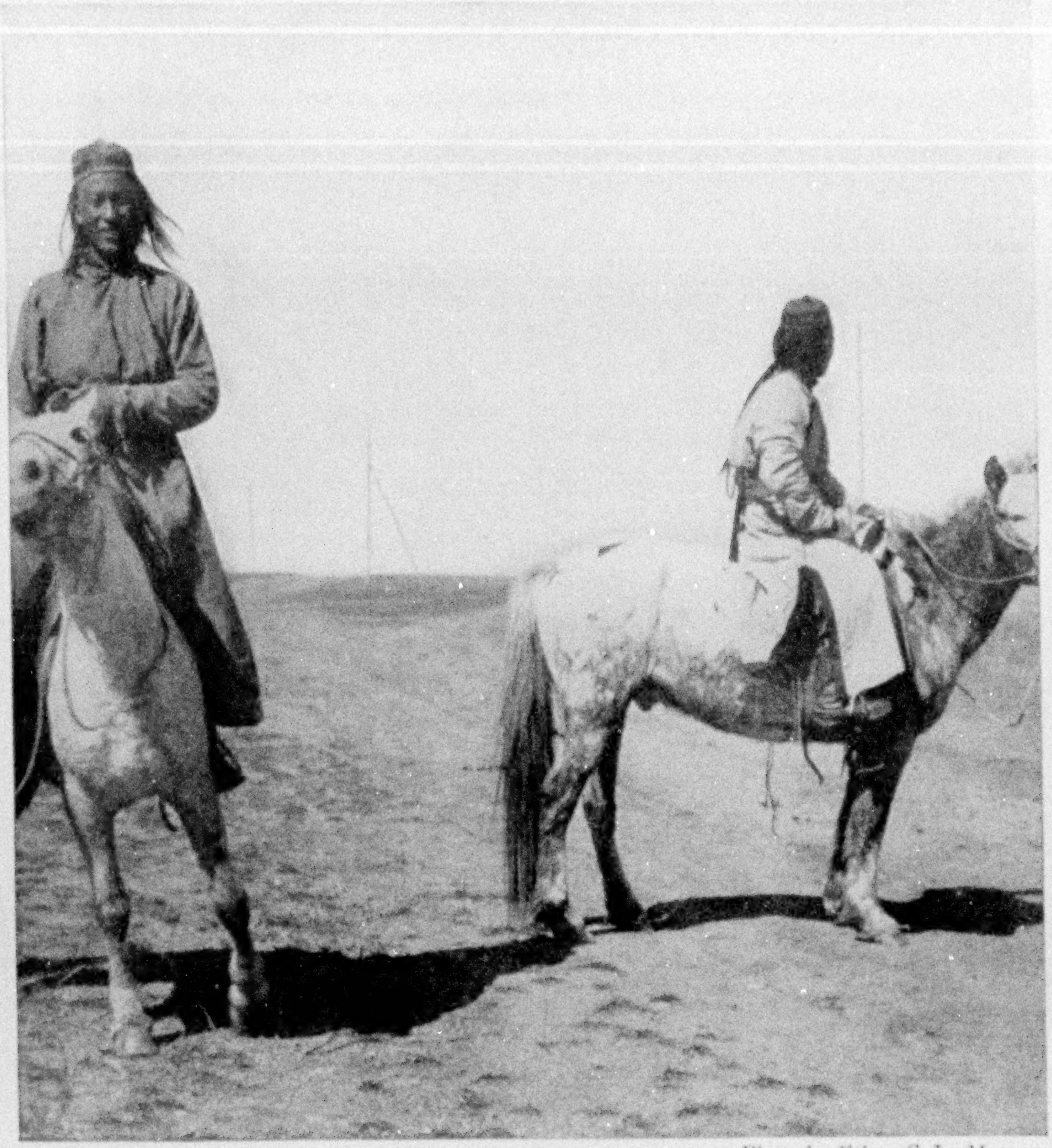

Photo by Ethan C. Le Munyon

TYPICAL MONGOLIAN HORSEMEN

They are not lamas, but ordinary civilian Mongols, who own herds, tents, etc.

we saw hundreds of antelope, in groups of from 5 to 50; all became frightened, and in one case they ran ahead of the car, crossing the trail about 100 yards in front of us.

About sundown the road became very rough and hilly, and several soft places were passed over where the water came out of the ground as seepage. These places were on side hills, and all indications pointed to the fact that it would be a good place to develop water by artesian or other methods. This will be done, perhaps, when the country is settled by an agricultural people like the Chinese or the Russians. This is bound to come soon, for famines in China are driving the common people to new and more productive regions, and every year sees more and more of them in Mongolia, as well as Siberia and Manchuria.

As we saw that it would be impossible to reach Urga that night, we stopped the car near the trail and, wrapped in our fur coats and blankets, passed another night in the car.

We were now in the hills, which were at this time covered with dry grass. Dipping down into the valleys, we encountered water and very soft and marshy ground, and in going across one bad marshy place the car broke through the frozen ground and we stuck in the slippery mud. It was here necessary to wind long lengths of rope around the tires to obtain traction, and we had to

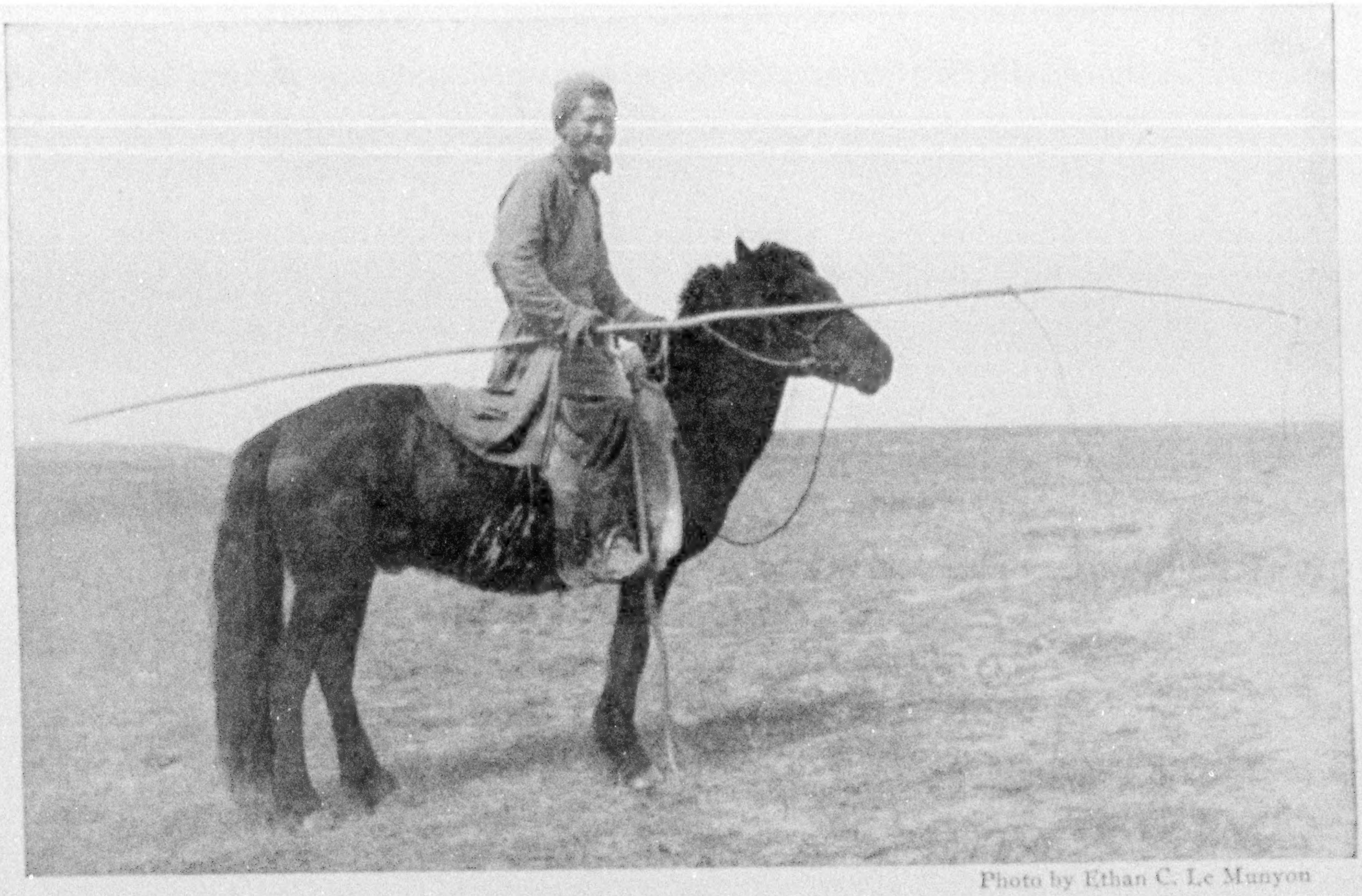

Photo by Ethan C. Le Munyon

A MONGOLIAN HORSEMAN

The pole with the slip-noose is used in place of the lariat, and is almost as effective. The rider drives into a herd and "cuts out" the horse he wants, drops the noose over his head and soon subdues him.

Photo by Ethan C. Le Munyon

CATCHING HORSES ON THE PASTURE LANDS OF MONGOLIA BY THE AID OF A POLE

XUM

Photo by Ethan C. Le Munyon

A GROUP OF MONGOLIAN WOMEN AND CHILDREN

The second adult from the left is a Buddhist nun. These natives have been in contact with foreigners and are therefore cleaner than the average native

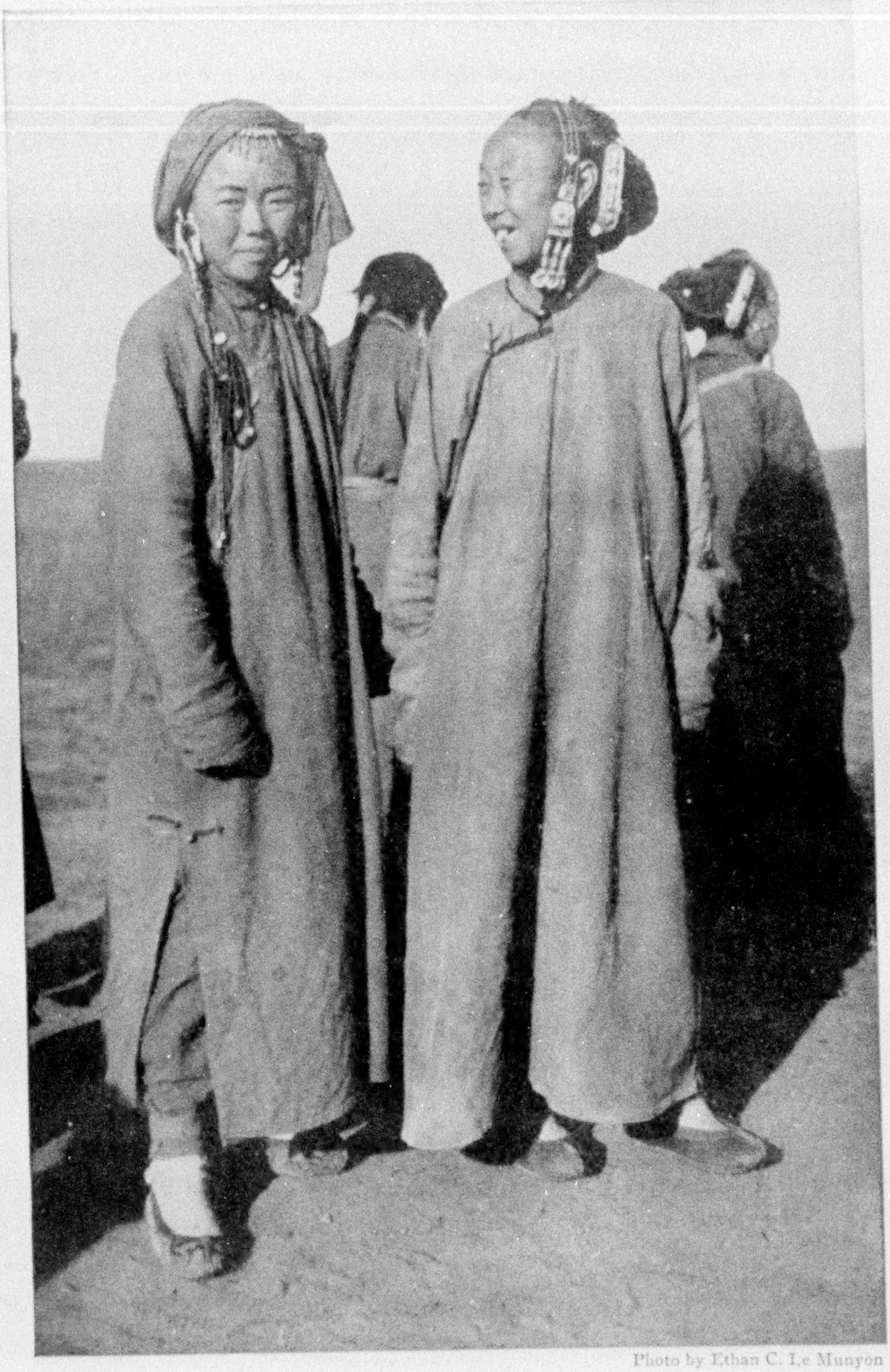

Photo by Ethan C. Le Munyon

WELL-TO-DO MONGOLIAN WOMEN OF SOUTHERN MONGOLIA

Note the heavy silver ornaments used to dress the hair. This always represents their wealth

XUM

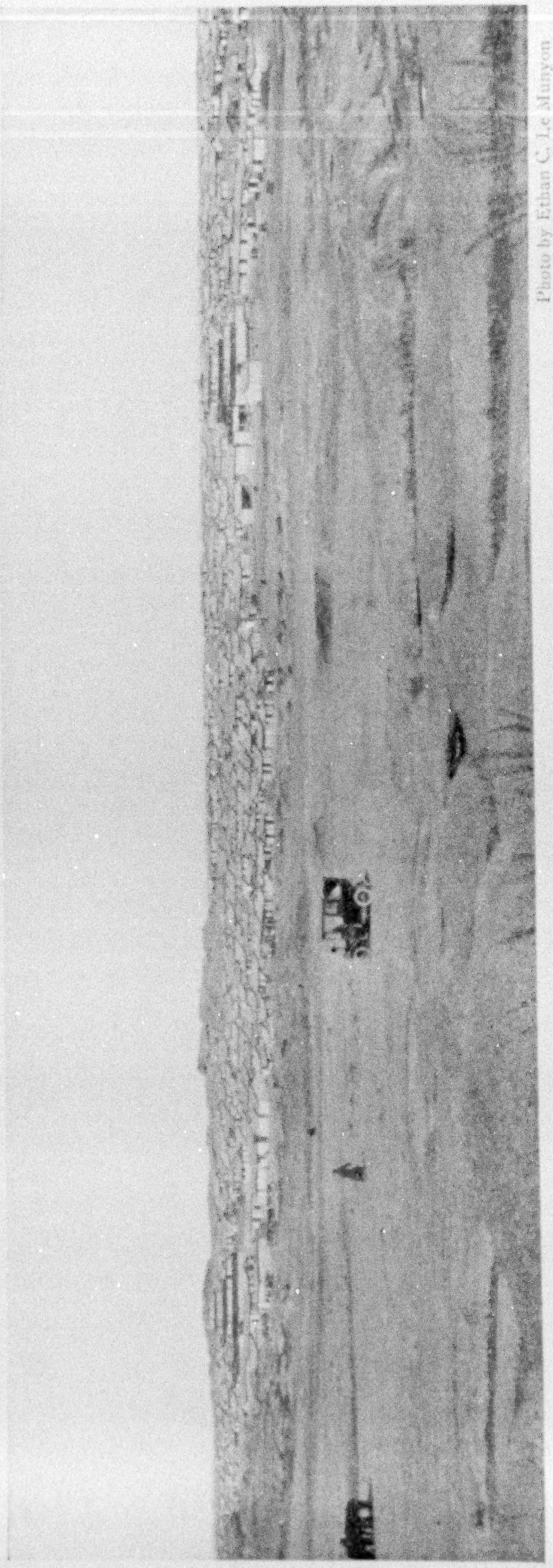

Photo by Ethan C. Le Munyon

THE TOWN OF SUME, SHOWING THE TWO MONGOLIAN TEMPLES IN THE DISTANCE SURROUNDED BY THE SMALLER QUARTERS OF OVER 2,000 LAMAS: IT IS A SORT OF MONGOLIAN LAMA SCHOOL

dig trenches for the wheels in the mud for about 75 feet to solid ground; for if we did not do this, the wheels would spin around without moving the car.

A small lake or two were passed where we saw a great many wild-fowl. Most of the grades that we went down here were so steep that we left the clutch in, shut off the power, and went down under compression, using the brakes at the same time.

From time to time groups of native *yurts* (tents) were passed by the side of the trail. The women of this part of Mongolia dress their hair very differently from their sisters of southern or inner Mongolia. The dress of the men, however, is the same.

Arriving at the Tola River, we crossed by way of the Russian bridge, which is constructed of logs. The Tola at this point is about 300 feet wide and from 5 to 10 feet deep at that time of the year. The surrounding mountains were covered with a forest of larch. After crossing the bridge and traveling up the river-bed, fording the smaller tributaries from time to time, we arrived at the native Chinese city of Mai-Mai-Chen, which is the business place of Urga. It is about five miles east of Urga proper, where the Mongol temples and the Russian traders are located. The Chinese telegraph office and a branch of the Ta Ching Bank (government bank) are situated at Mai-Mai-Chen.

After giving the car a thorough inspection and making some needed adjustments, we washed it and covered it up, awaiting instructions from the god regarding its delivery. Time is without value among the Mongols; the higher the official, the longer it takes to

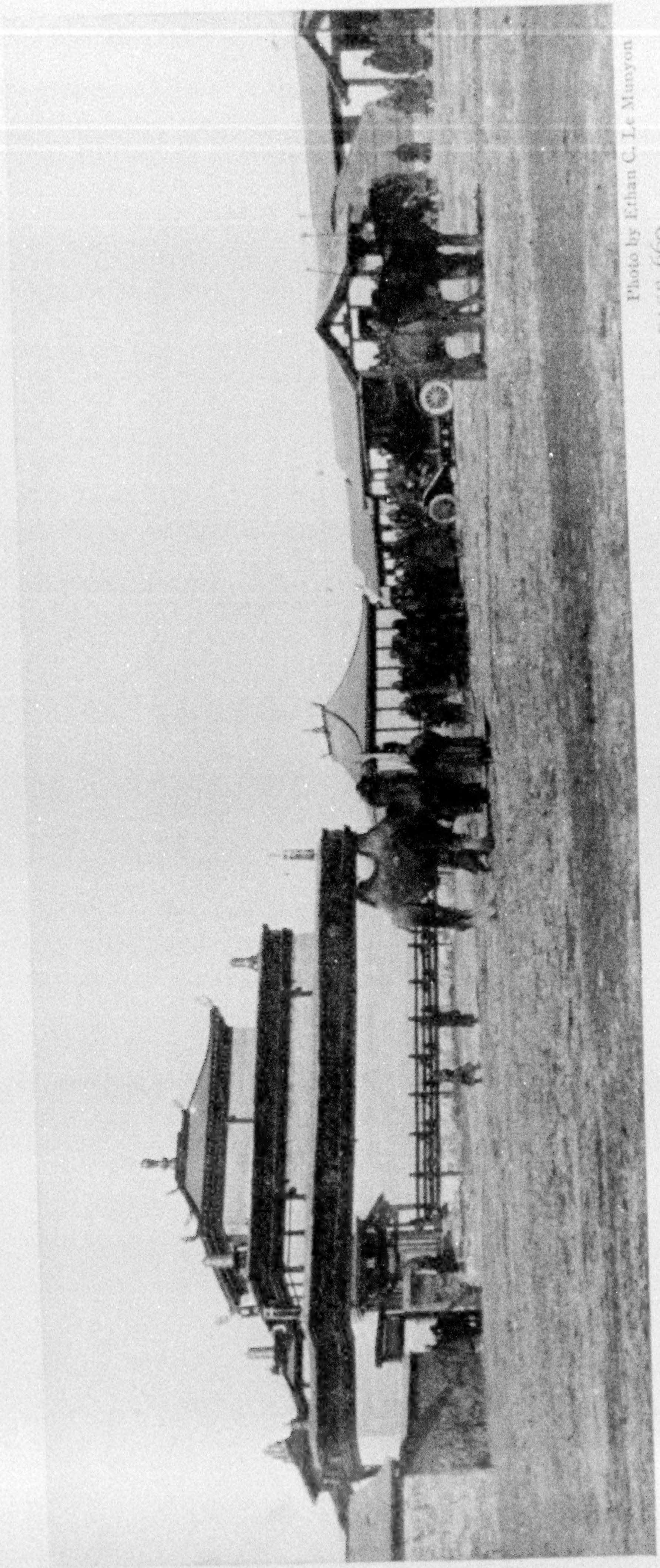

Photo by Ethan C. Le Munyon

A CLOSER VIEW OF THE SECOND TEMPLE AT SUME SEEN IN THE ILLUSTRATION ON PAGE 660

The cylinders standing upright on the roof are prayer-wheels, which are gilded with gold leaf and turn in the wind. Written prayers are put inside, which revolve and pray

deal with him, and in this case, as it was the god himself that we had business with, it would take a long time. Needless to say, the car was a seven days' wonder to the natives of Urga.

While awaiting the pleasure of the god, we wired the car so that we could drop a small chain on the ground, and when the motor was running no one could touch the car without getting a slight shock from the magneto. This afforded us quite a little fun at the expense of the natives, who could not understand what had "bit them," as they expressed it, and did not leave a mark.

As we were to see the Buddha and had brought the car all the way from China for him, we were shown great respect by the natives.

The population of Urga is hard to estimate. During the autumn and winter months there are from 20,000 to 30,000 lamas here.

There are countless temples and long lines of prayer-wheels beside the road. One temple contains the shrine of "Maidari," the future ruler of the world, an image of metal about 30 feet high, which is estimated to weigh 125 tons. It was cast in sections and brought to Urga from Dolonor, a city 600 miles east of Urga, where

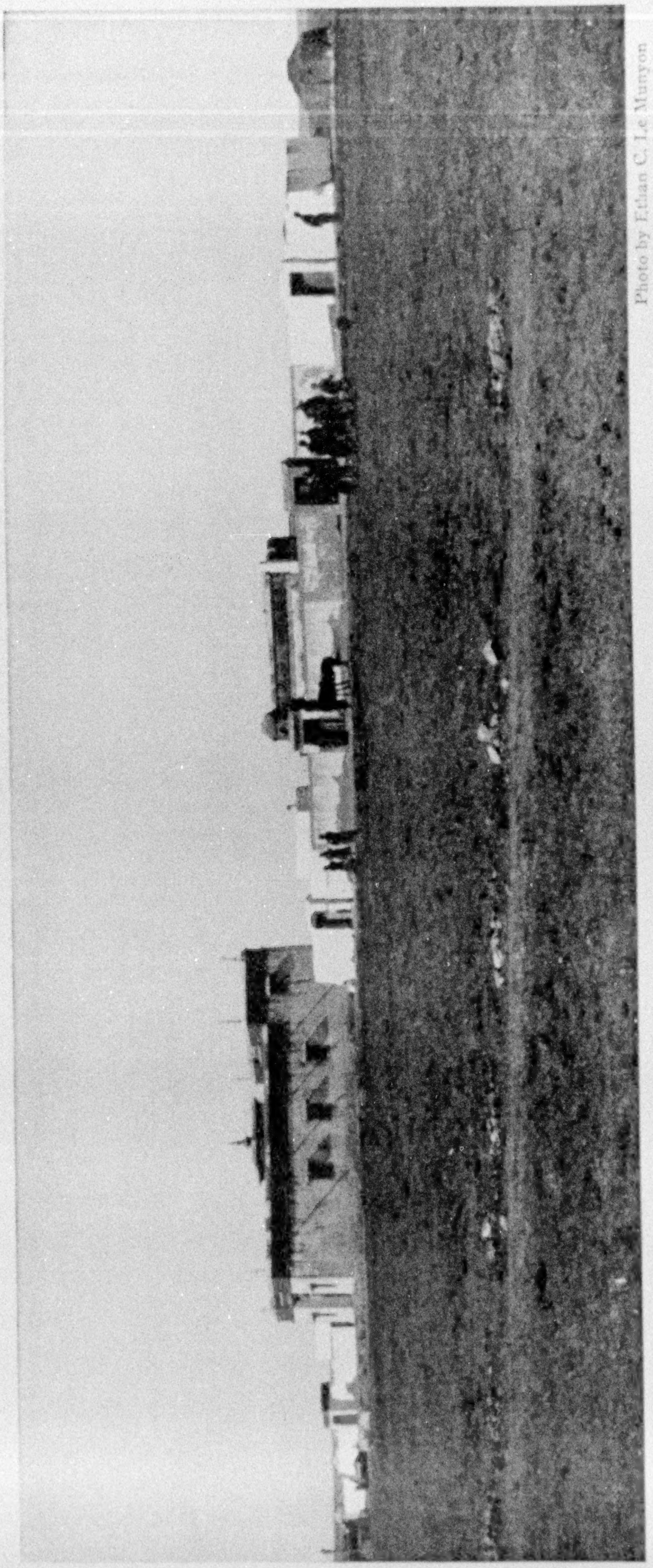

Photo by Ethan C. Le Munyon

A MONGOLIAN TEMPLE OR "SUME," TIBETAN STYLE OF ARCHITECTURE, OF PLASTERED STONE AND BRICK: AN EXCEEDINGLY DIRTY, FILTHY PLACE

it was designed and cast.

The temples of Urga are many and of all kinds. Some are no more than large tents and others are resplendent in vivid colors, gold leaf, and gilt. Some follow the Chinese style, some the Tibetan, and others seem to have a sort of style common to neither.

There are few regular streets in Urga, with the exception of the main street, along which are lines of prayer-wheels, which are sheltered by small shanties or sheds. These are turned by hand by the people who wish to pray. Prayer flags float over all tents and temples and smaller prayer-wheels turn in the wind, while gilt prayer-wheels swing from the roofs of the temples.

Urga was the residence of a Chinese lieutenant governor, or "amban," as he was called, the representative of the Chinese government. Since Mongolia declared herself independent of China, early in the year 1912, there has been no amban, the former one having fled, reasoning that he was not needed. The god was crowned Emperor of Mongolia, and as he was actually the religious head it made his position doubly secure. Whether China will ever again obtain con-

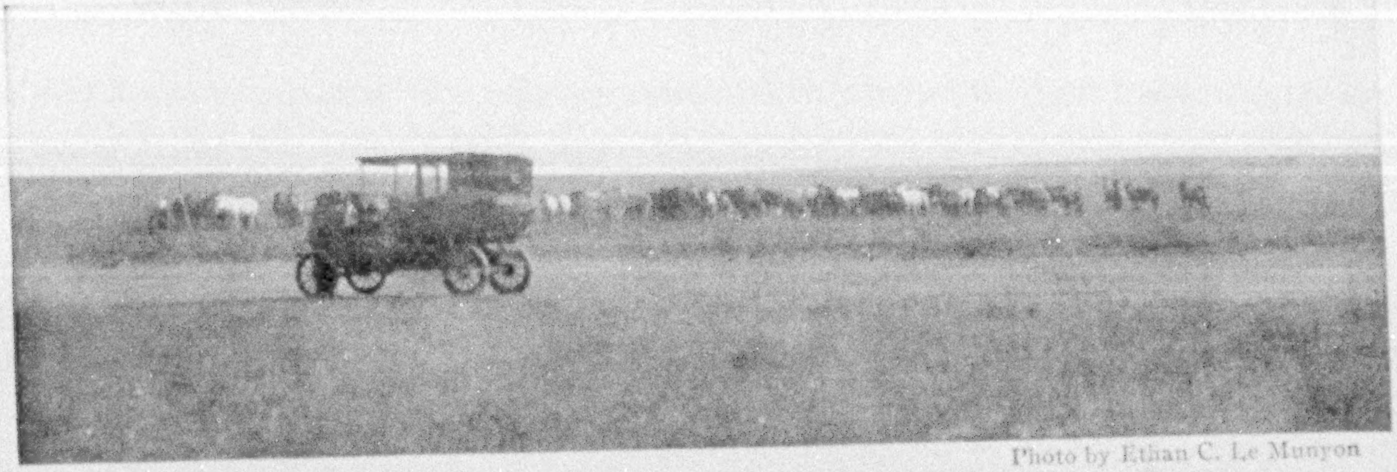

Photo by Ethan C. Le Munyon

PASSING A GROUP OF WILD HORSES, COMMONLY CALLED MONGOLIAN PONIES

trol of Mongolia, time alone will tell; but for a long time Russia has cast a covetous eye on it.

The houses and business places in Urga are surrounded with stockades of large logs set on end and sharpened at the tops in some cases, while in others they are left square at the top. These stockades are 15 to 20 feet in height and afford effective protection against intruders and thieves.

A common sight in the streets of Urga is the Russian tarantass, a clumsy four-wheeled cart without springs, to which are hitched three horses abreast; they are extensively used to carry passengers between Urga and towns on the northern border.

Urga is surrounded by high mountains on all sides. One of these, Bodga Ol (Buddha's Mountain), is heavily wooded with forests of larch and no hunting is allowed. In the districts between Urga and Kiachta are extensive pine forests.

Urga is without doubt one of the very few cities seldom visited by the foreigner, as it is no holiday trying to reach it even from the Transiberian Railway. It means five or six days of continuous traveling in a tarantass and by boat, while to reach it from the China side it is necessary to cross the Gobi Desert, a distance of about 700 miles.

The street scenes are many and varied. The women ride past on swift-footed Mongol ponies. Long lines of bullock carts go by, in most cases loaded with wood from the near-by mountains. Here is also seen the Tibetan yak, used as a beast of burden. The trade of the place is in the hands of the Chinese, although there are a few Russian stores. The Russian government has a consulate here and a large garrison of soldiers. The offices of a large gold mining company are also located here, the mine being between Urga and Kiachta.

WHAT THE LIVING BUDDHA IS LIKE

About a week after our arrival the car was delivered to the god, who entertained us at lunch, if such it might be called. We drove the car inside the compound of the palace, which was a sort of stockade built of logs set on end (see page 668), and took some of his chief officials for a drive outside, which pleased them very much.

After the business of turning over the car had been completed, the god, through his head lama, presented the writer with a bolt of imperial yellow brocaded silk, wrapped in a blue silk scarf.

The god is about 40 years of age. His appearance is not prepossessing. He has a bull neck and a hard-looking face and seems more like a cut-throat than a holy pontiff. He is almost blind. It may be remarked here that blindness is a common complaint among the Mongols, and while it is usually caused by a lack of personal cleanliness, there are other causes. The fuel burned in Mongol tents is *argol*, or dried camel dung; it is burned in an open grate in the middle of the tent, and the fumes cause an irritation of the eyes as well as the lungs. This is the only fuel on the Gobi; even in Urga it is burned in place of wood, as it is cheaper.

Some years ago the Buddha was a gay young spark, and although his morals

Photo by Ethan C. Le Munyon

WOMEN OF NORTHERN MONGOLIA: NOTE THE DIFFERENCE IN HAIR DRESSING AND THE PADS ON THE SHOULDERS OF THE WOMAN ON THE LEFT

Photo by Ethan C. Le Munyon

A TYPICAL WOMAN AND CHILD OF NORTHERN MONGOLIA

Note the method of dressing the hair; also the pads on the shoulders. The head-piece is of beaten silver set with red-stones

XUM

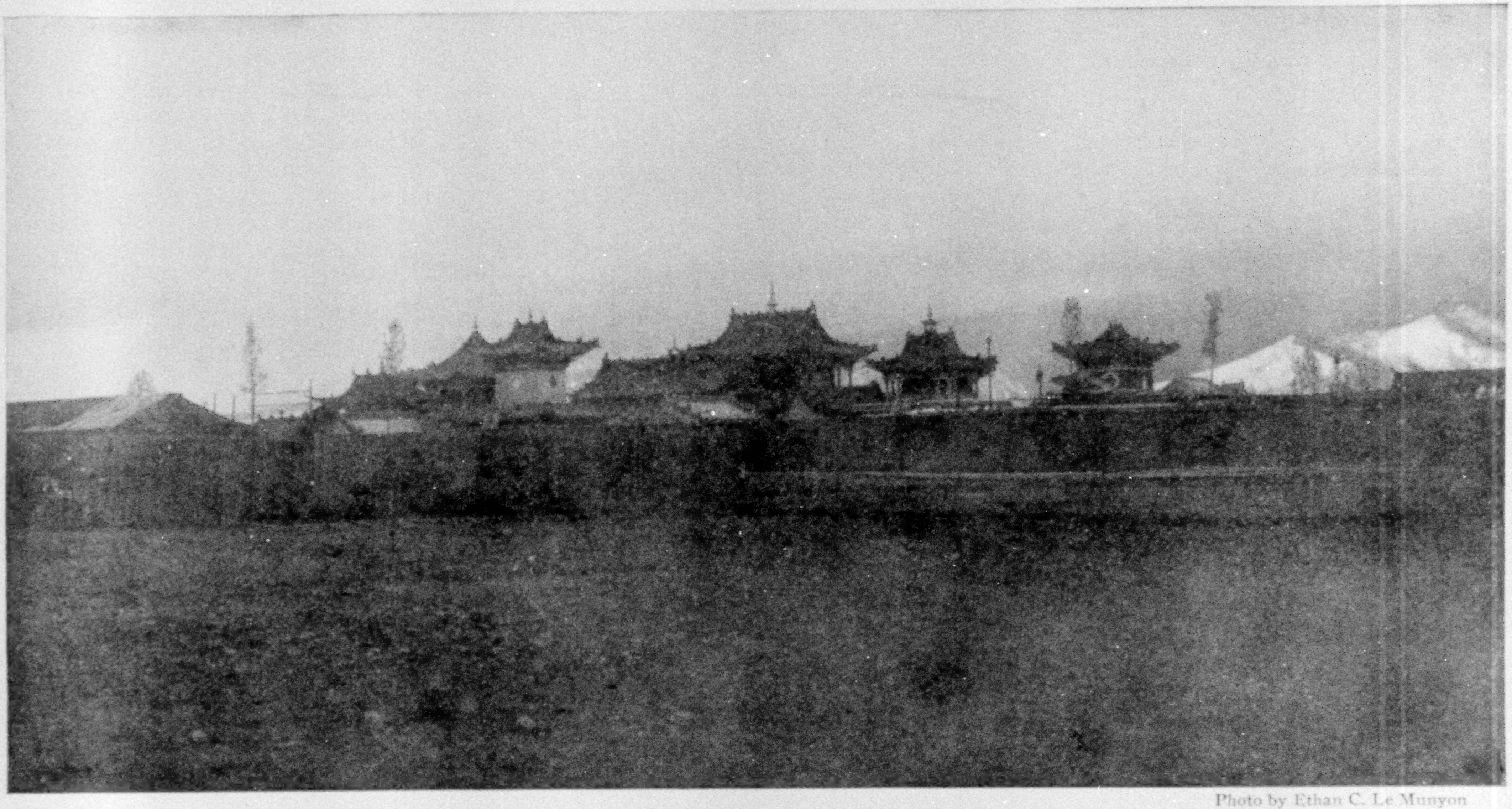

Photo by Ethan C. Le Munyon

THE TEMPLE AT URGA WHICH CONTAINS THE SHRINE OF MAIDARI (THE FUTURE RULER OF THE WORLD): THE IMAGE IS 33 FEET HIGH AND IS ESTIMATED TO WEIGH 125 TONS (SEE PAGE 661)

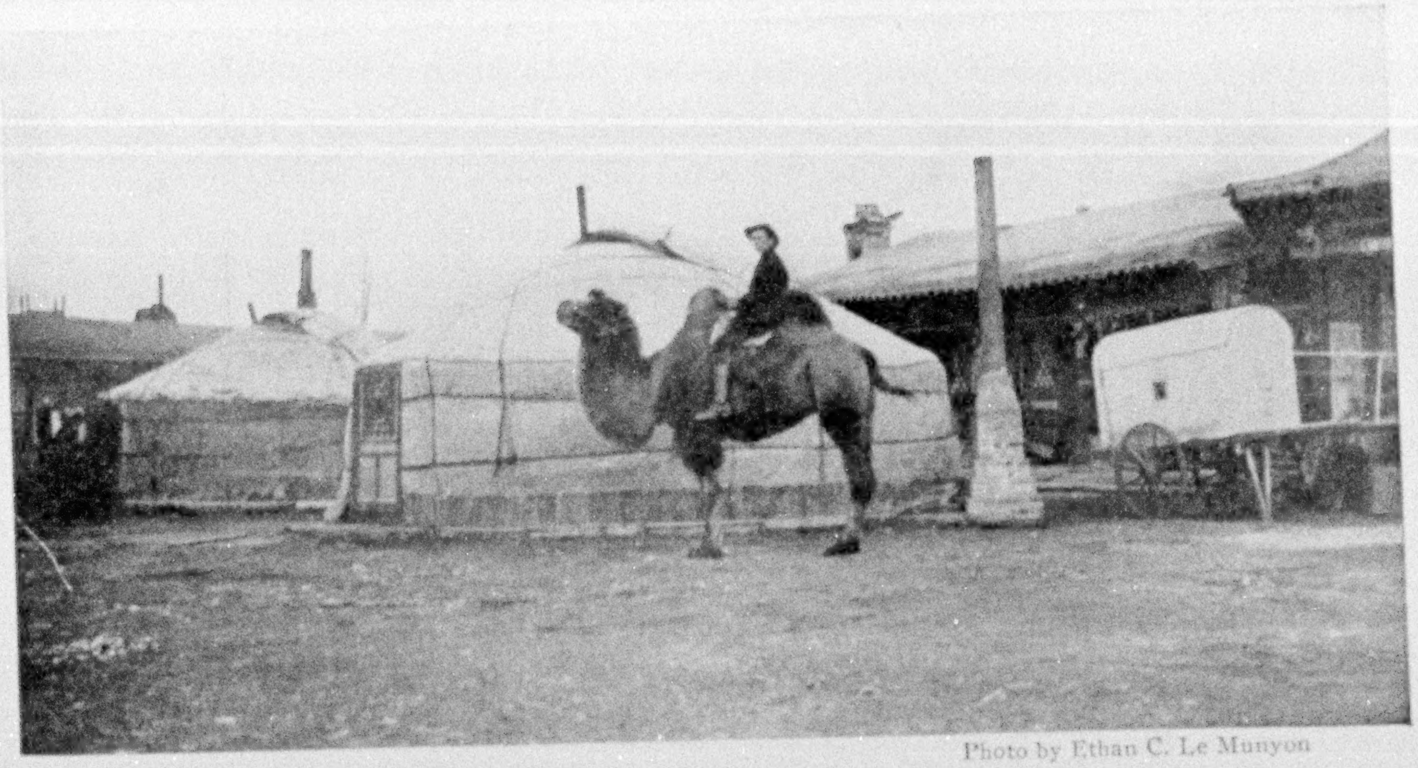

Photo by Ethan C. Le Munyon

THE WRITER OUT FOR A MORNING RIDE—MONGOL "YURTS" AND CAMEL CART IN BACKGROUND: URGA

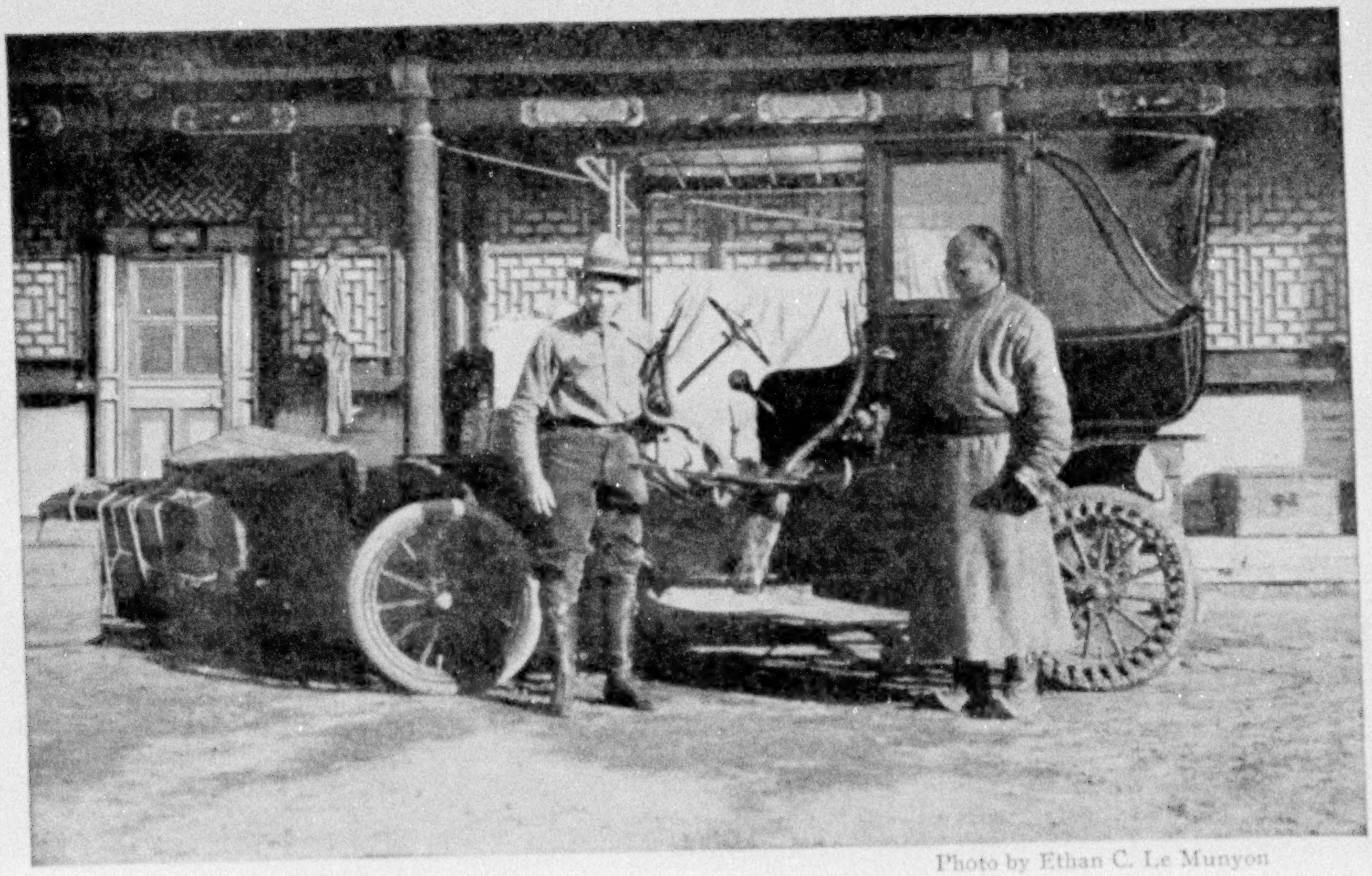

Photo by Ethan C. Le Munyon

THE MONGOL WITH WHOM THE WRITER STOPPED WHILE IN URGA: THE PHOTOGRAPH WAS TAKEN IN THIS RICH MONGOL'S COMPOUND

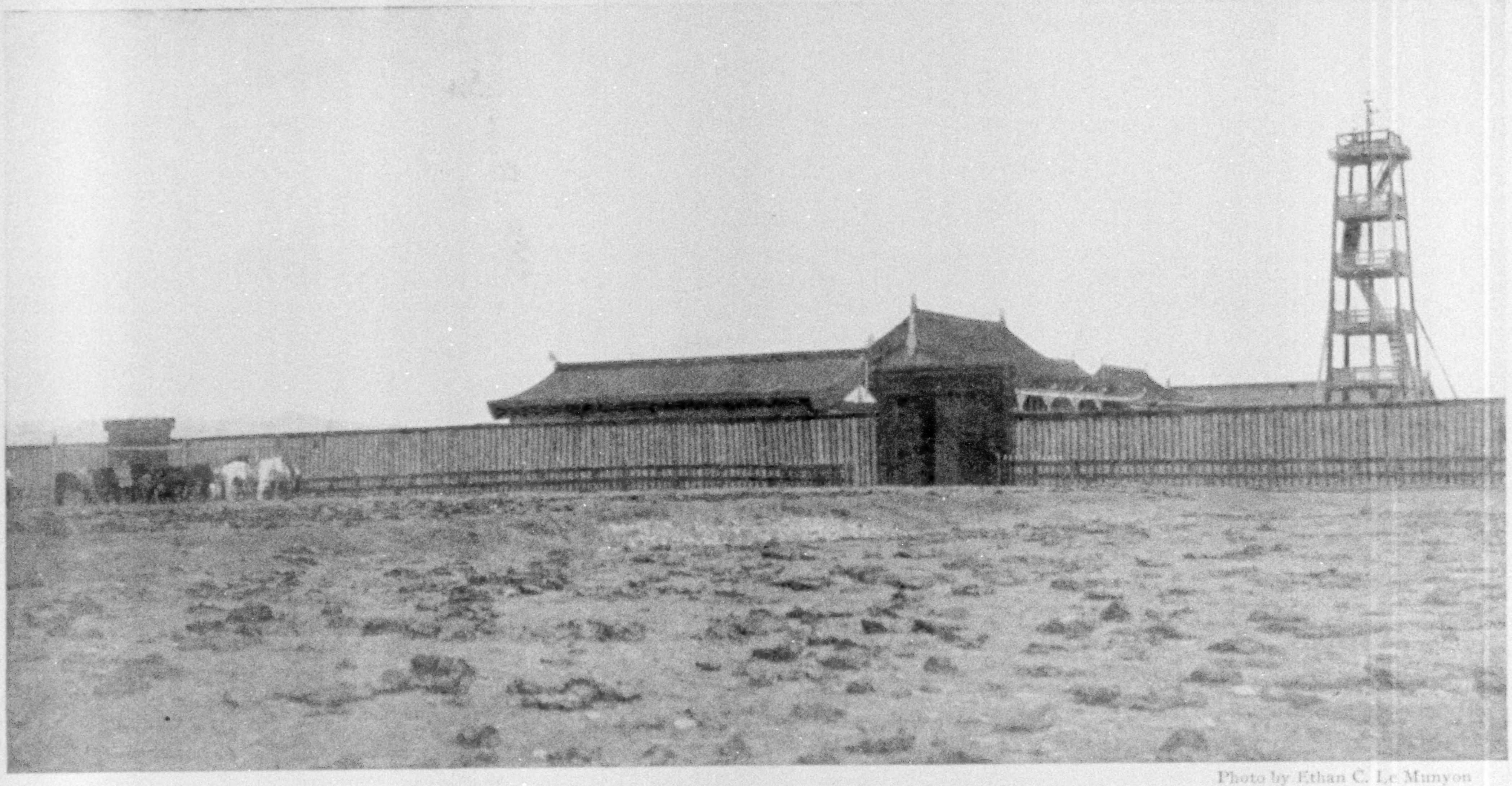

Photo by Ethan C. Le Munyon

EXTERIOR VIEW OF ONE OF THE GOD'S SUMMER PALACES, WHERE THE MOTOR-CAR WAS DELIVERED

Note that it is surmounted by a watch-tower, and is also surrounded by a palisade of logs. In the foreground is "Argol" drying camel and animal dung, which is used as fuel in this country

are said to have improved since then, he has not entirely given up his former modes of life. In spite of the tenets of the Buddhist religion, which prescribe celibacy for all lamas, the god is said to be very susceptible to feminine charms, his favorite being a tall Mongol girl. It is said that her influence over her divine lord is very great. She has commercial instincts and, besides the large sums and presents which she receives, she is reported to own a store in Urga and to be fairly rich.

The god has only to express a wish and his faithful adherents compete with each other to supply his needs; whether it is a watch, a horse, motor-car, or a new concubine, one is obtained at once. At the present time he is seldom seen by foreigners. He has three palaces in Urga and spends some little time in each. One place is copied from the Russian consulate; the others are of the native type and quite imposing.

Mongolia is one of the most interesting countries in the world today and also one of the most primitive. The inhabitants in many ways resemble our own North American Indians. They have a written language, are blindly devoted to the Buddhist religion, and very fanatical. The lamas, or Buddhist monks, are the curse of Mongolia and are parasites living on the religious credulity of their lay brethren.

The highlands of Mongolia vary in altitude from 3,000 to 5,500 feet. There are many mountain ranges, and in very few places is the country level for any considerable distance. The word Gobi means a "barren or desolate plain." Vegetation is absent, with the exception of a few grasses, so that argol (or dried camel dung) is the only fuel used. It is collected and stored in large quantities for use during the winter.

Water is scarce, a few wells along the caravan route furnishing the entire supply. During the winter and spring the camel is the only animal that can cross the desert and subsist on the dried-up grasses. At this season of the year blocks of ice are carried for the water supply, and at other seasons two large tubs are carried on each camel, used for this purpose, one tub on each side of the camel.

The medium of exchange is the Chinese tael (an ounce of silver). Small squares or cubes of pressed silk are also used, but brick tea will pass current for barter in any part of Mongolia. Tobacco is also used for this purpose. The trade is in the hands of the Chinese, with the exception of the Russian traders in Urga. There is a Russian and also a Chinese post-office in Urga. Both maintain a pony express route across the Gobi; the time is 7 days.

A CURIOUS METHOD OF BURIAL

Mongols look on the dead in a different light from the Chinese, and their dead are taken just outside the town and thrown down. The dogs, sometimes those from their own tent and also others, soon make short work of them; in a couple of hours nothing is left. The natives believe that the quicker this happens, the better chance the spirit of the departed has in reaching Paradise.

The Mongol is a great meat eater, living in some cases entirely on mutton. In comparing other foods, he will ask if they are as good as mutton. It is not uncommon for a Mongol to consume 10 pounds of this meat at one sitting. He puts mutton fat in his tea, which is prepared with milk from the brick tea (poorest grade pressed in bricks), and of this he drinks enormous quantities; 30 cups per day is not an uncommon amount for an adult. There are no regular hours for eating; the native eats when opportunity offers. Game is not common near Urga, but many varieties are found in the mountains, though hunting on Bogda Ol (Buddha's Mountain) is prohibited.

After having delivered the car, we left for Kiachta and the Transiberian Railway, riding in a Russian tarantass. By traveling four days and four nights we arrived in Kiachta in time to catch the river steamer going down the river to the railway the following day. We arrived back in Tientsin after an absence of 32 days, having traveled 1,200 miles over-

Photo by Ethan C. Le Munyon

A MONGOLIAN PRAYER-WHEEL IN THE STREETS OF URGA

This is only one of about 100 that line the main road or street. It is an octagon wheel on a vertical shaft. The pilgrim or worshiper walks around it, revolving the wheel at the same time (see page 662).

land by conveyances other than the railway. The total distance covered was 3,300 miles in 32 days, during which time for eight days no traveling was done—one day at Tob Ol and seven days in Urga; also a day and a night between Urga and the railway.

This was the first time that a closed car had ever been driven across any desert country. This was also the first car to cross the Gobi Desert, other than a racer, two racers having crossed it in the Peking to Paris race. No tire changes were made in the entire distance; leather treads protected the back tires; the front ones ran bare; there was not even a puncture. Four months after our return from Urga (February, 1913) we heard directly that the car was running and giving good satisfaction.

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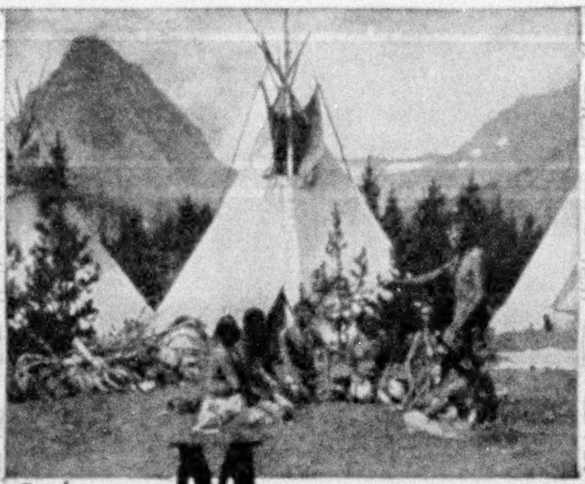

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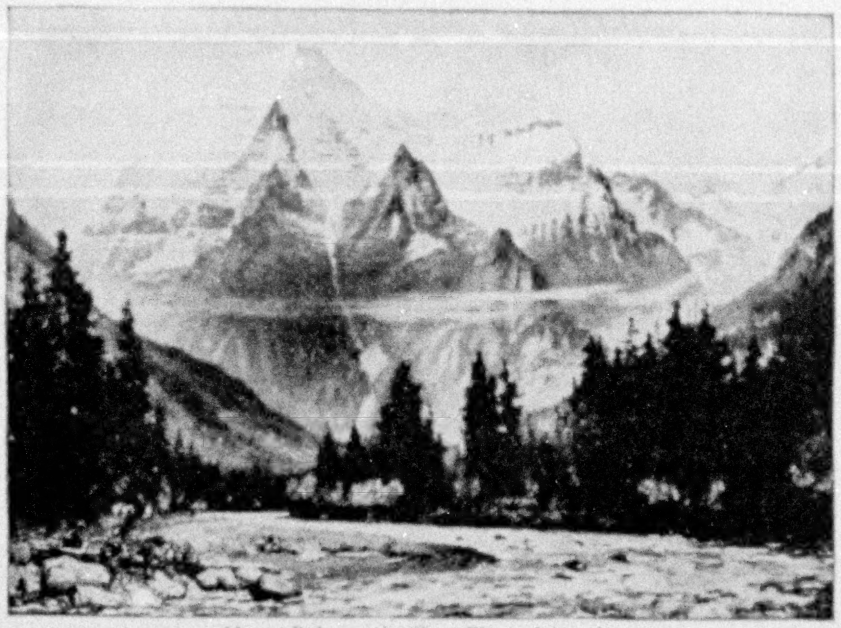

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MOUNT ROBSON

THE MONARCH *of the* CANADIAN ROCKIES

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COLOR WORK from this plant is remarkably attractive. The color sections entitled respectively "Glimpses of Japan" and "Scenes in Korea and China," which appeared in previous issues of this magazine, were products of this plant; as were also "The Hour of Prayer," "Panorama of Burgess Pass," and the "Bird's-eye View of the Panama Canal." We do color work for books, maps, cards, catalogues, portraits, etc.

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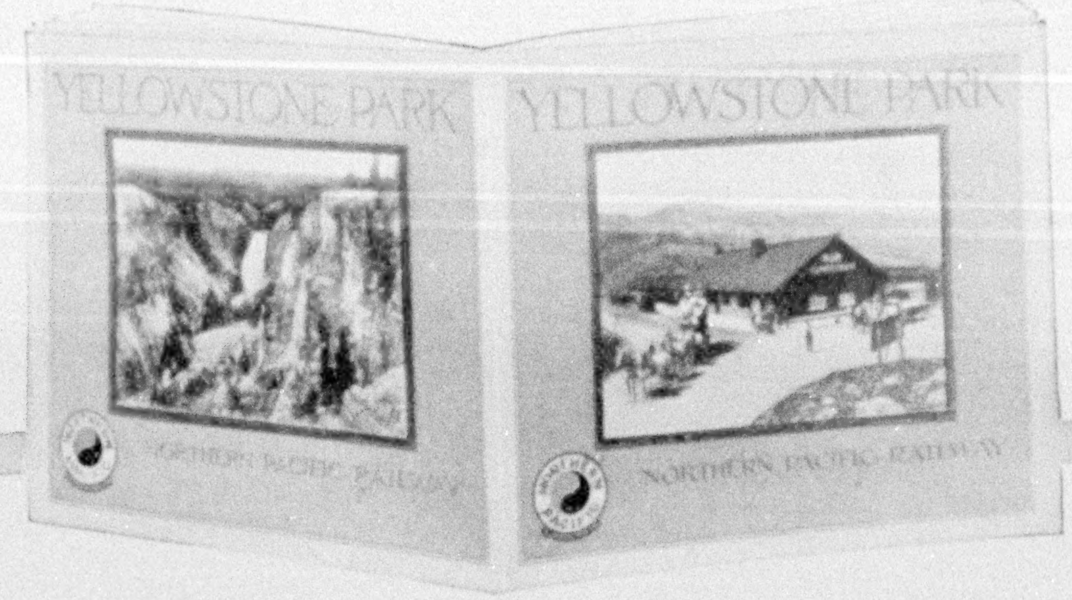

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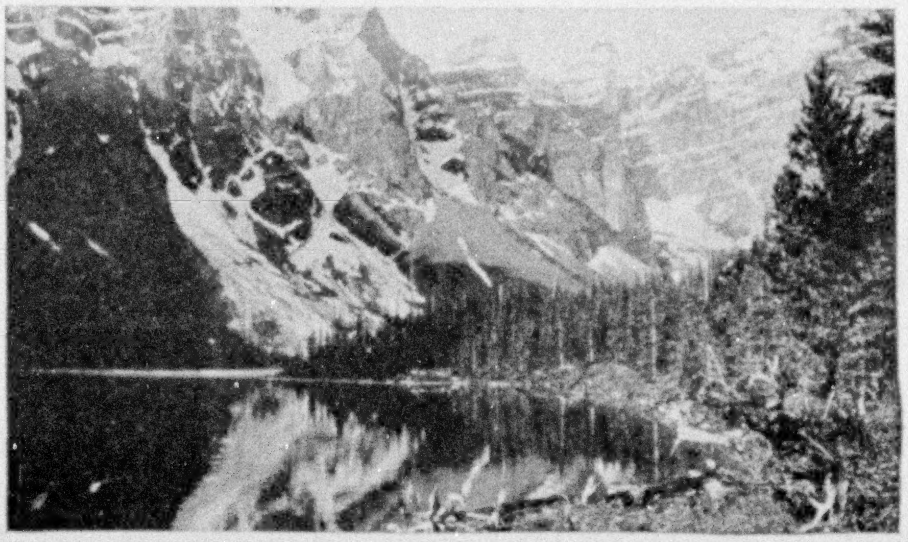
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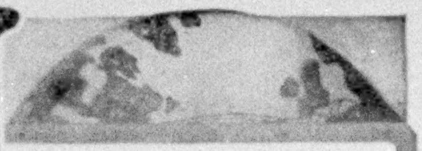

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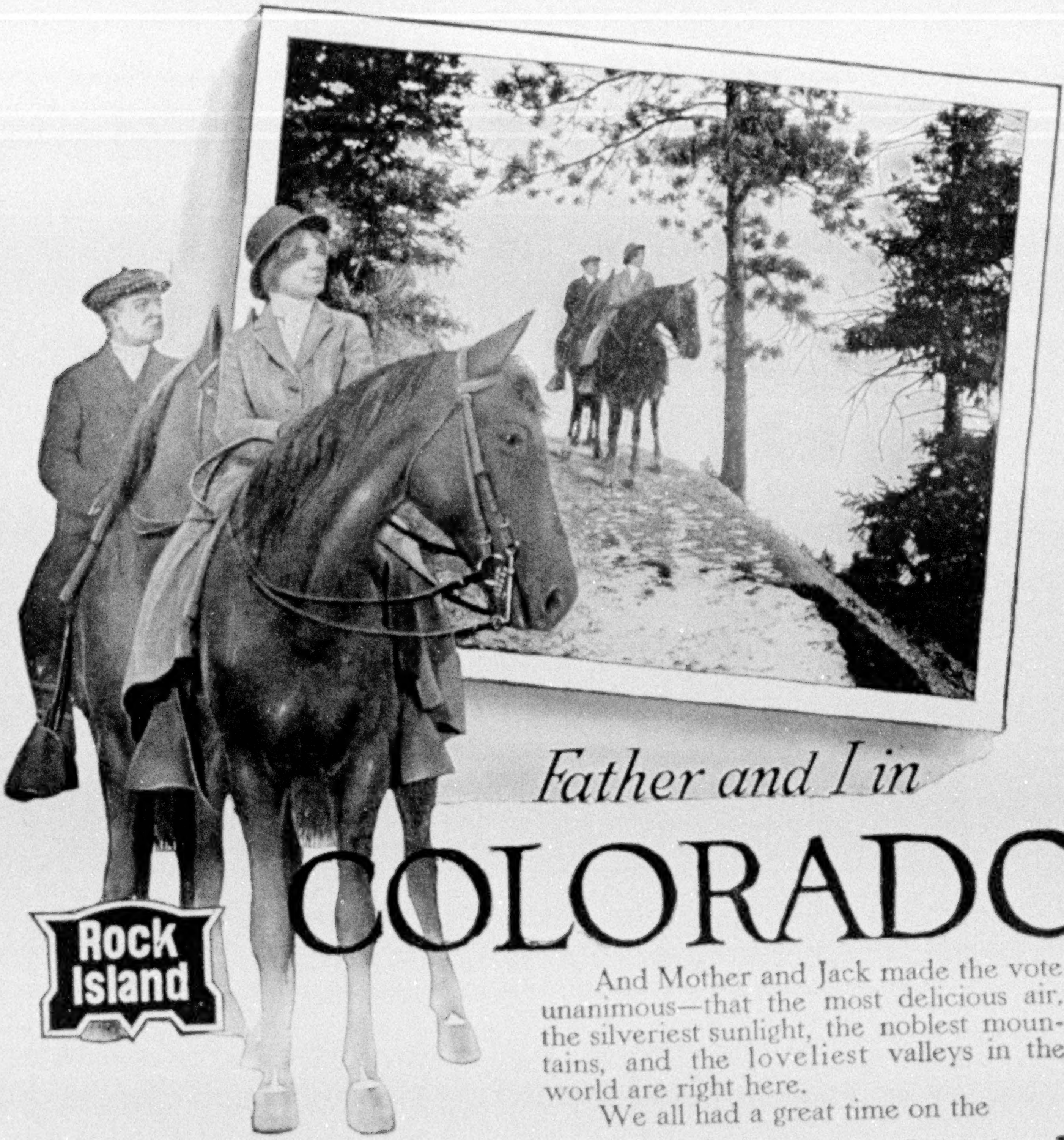

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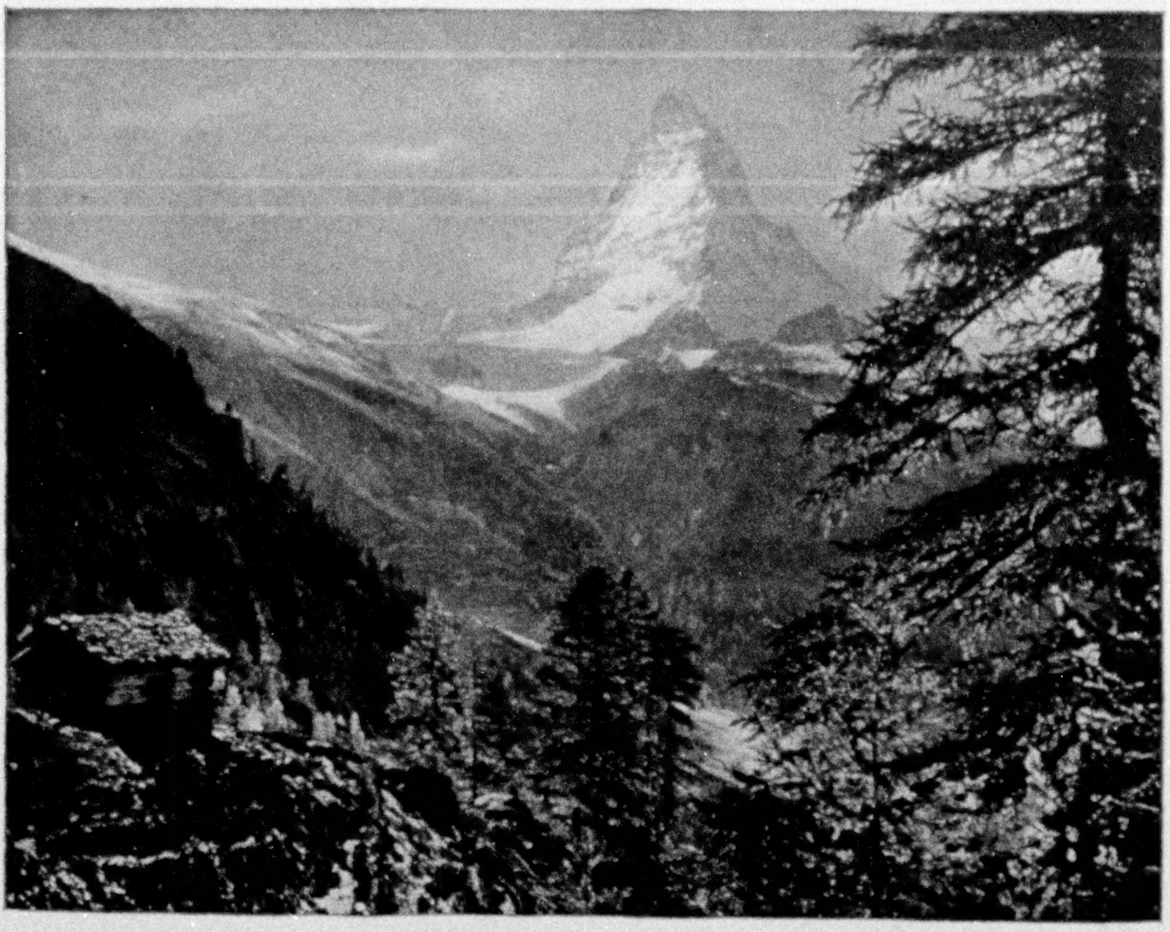

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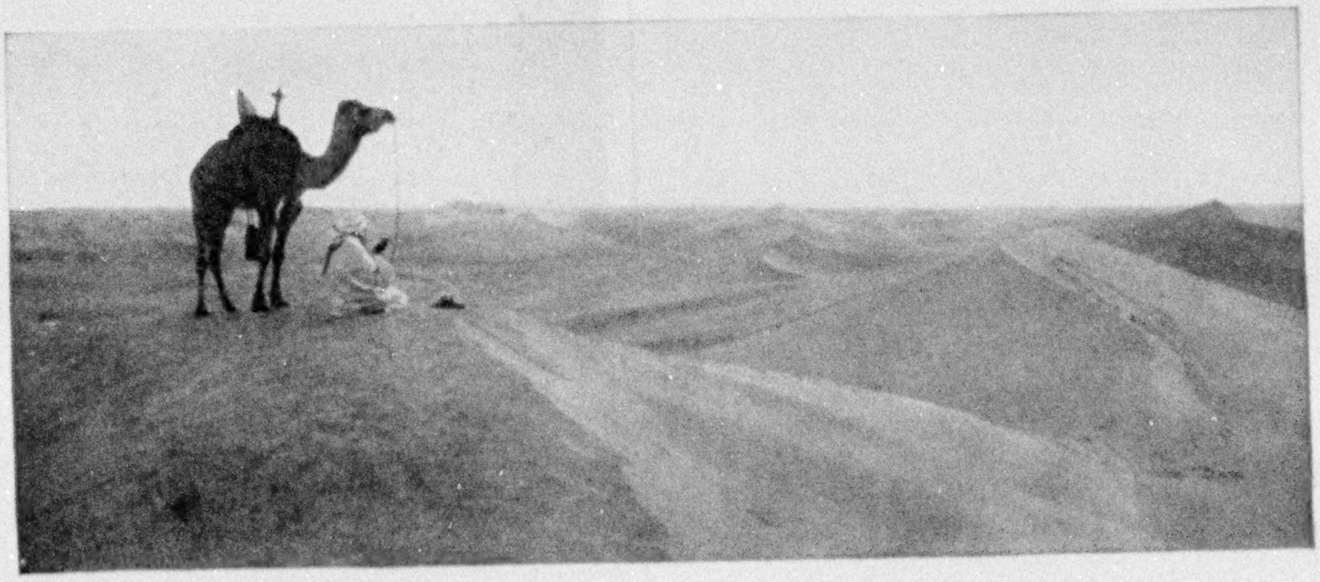

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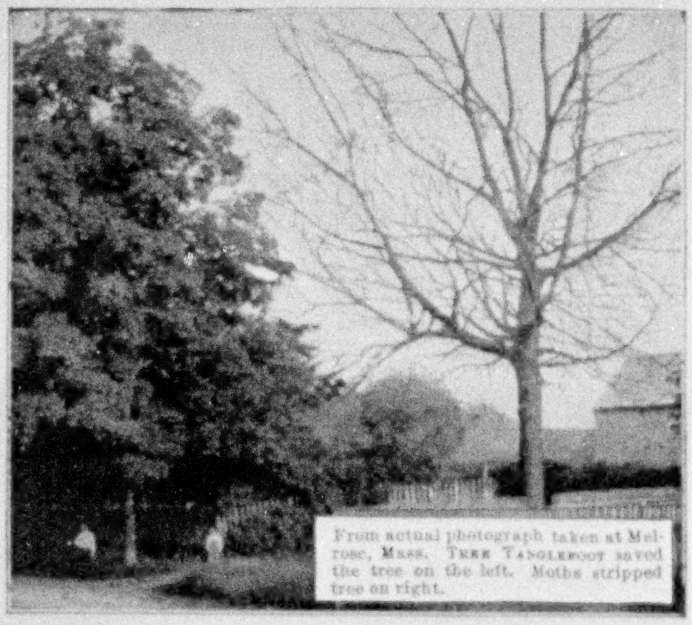

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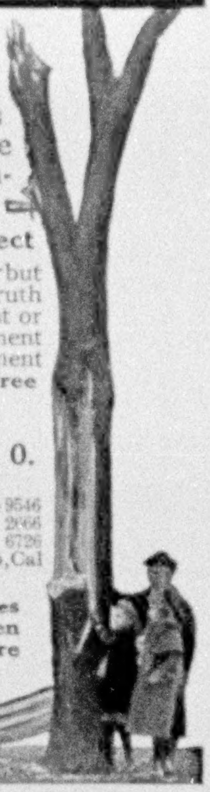

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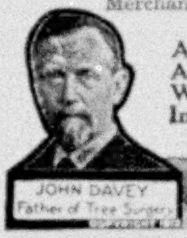

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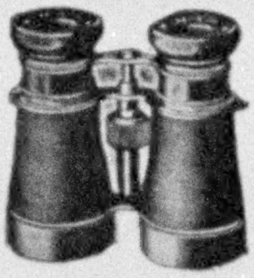

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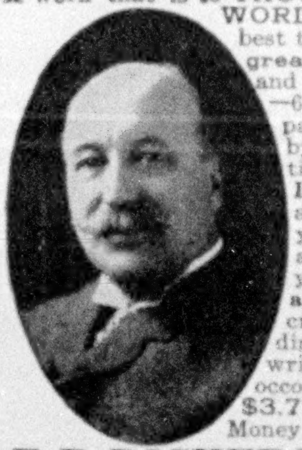

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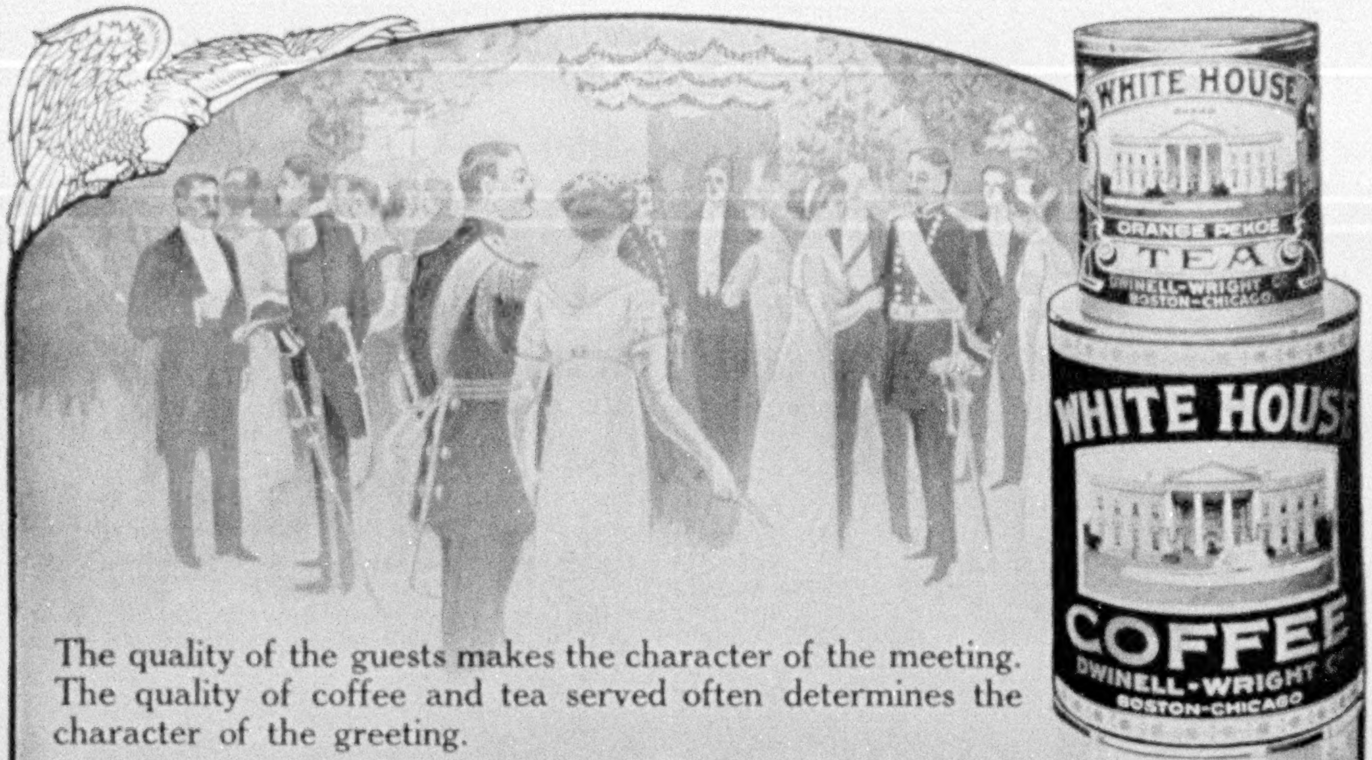

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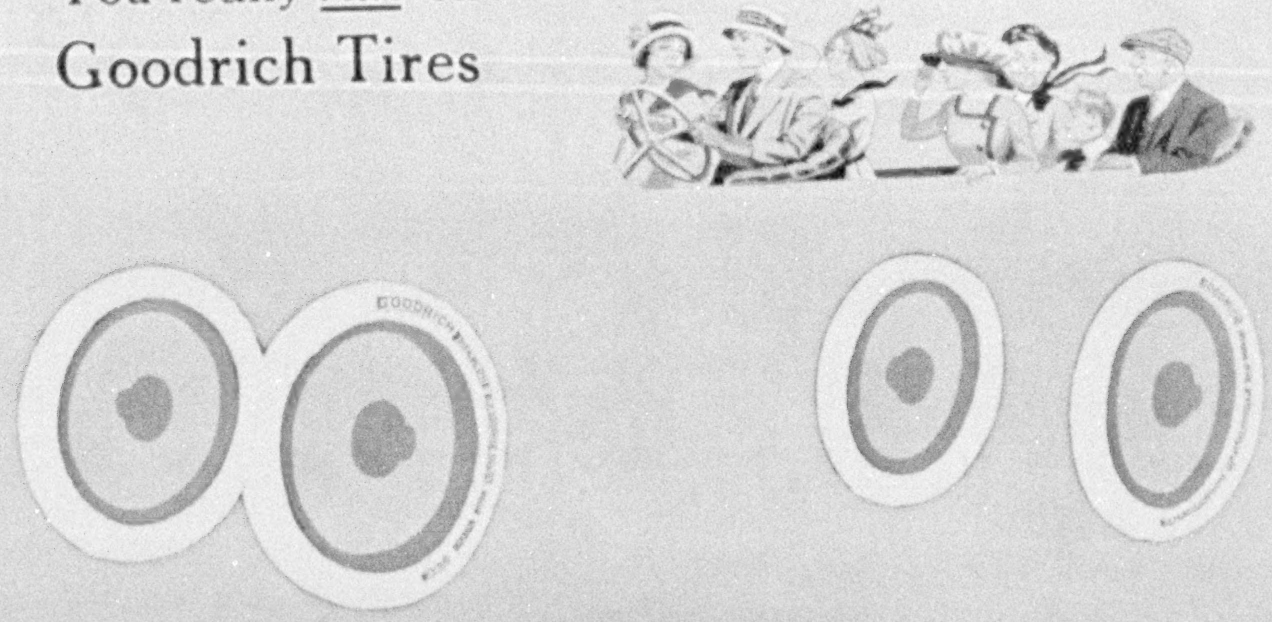

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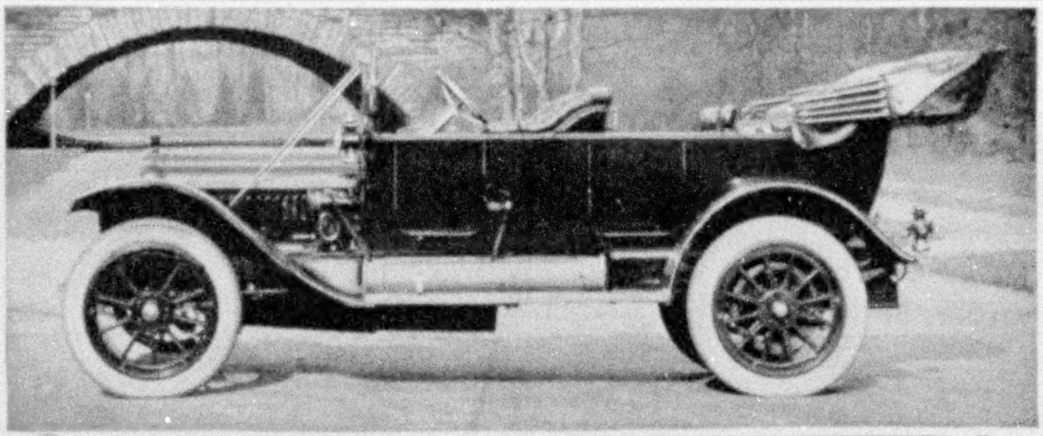

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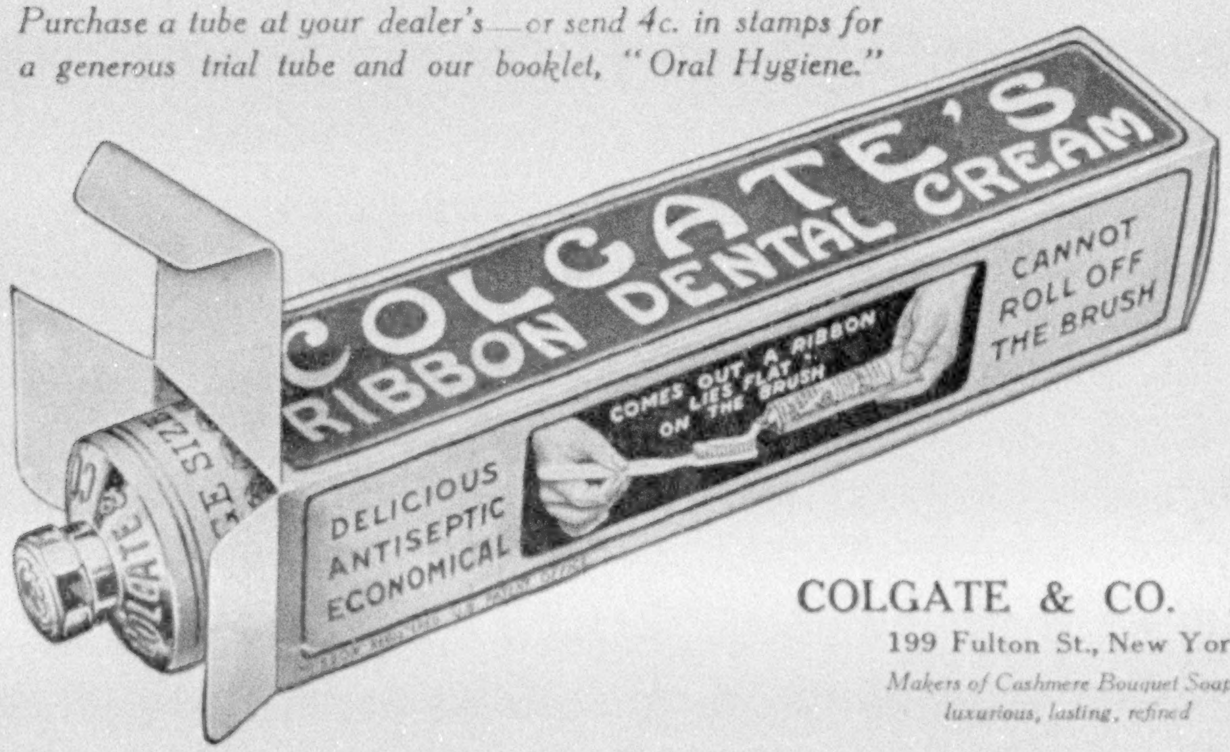

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